THE EFFECT OF HEALTH AND NUTRITION TRAINING AMONG HEALTH WORKERS ON ANAEMIA IN RURAL AREAS OF TANZANIA

A Study in Iramba and Kondoa Districts

Daniel Rodrick Nyagawa

A thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Philosophy in International Community Health
at the faculty of Medicine, University of Oslo

Oslo, Norway

June, 2001

The effect of health and nutrition training among the health workers on anaemia in rural areas of Tanzania

A Study in Iramba and Kondoa Districts

Daniel R. Nyagawa

A thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Philosophy in International Community Health
at the faculty of Medicine, University of Oslo

Main supervisor:	**Akhtar Hussain., MBBS., MPH., Ph.D.; D.Sc., Associate Professor**
Co-supervisor:	**Kagoma S. Mnyika., MD., MSc., Ph.D.**

Department of International Health
Institute of General Practice and Community Medicine

Oslo, June 2001

CONTENTS

Abstract

Objective: The study was designed to assess the effect of health and nutrition training among health workers on anaemia in rural communities of Tanzania.

Methods: The study utilised two sets of data. Data on haemoglobin levels (secondary data) for under five children and pregnant women attending maternal and child health clinics at the sentinel district hospital was obtained from Tanzania Food and Nutrition Centre (TFNC). Data was collected in the months of May and November from November 1997 to November 1998. At the sentinel laboratory a cyanomethaemoglobin method was used to determine haemoglobin concentration. Haemoglobin levels of less than 11 gm/dl was used to define anaemia for the two population groups.

Primary data on knowledge, attitudes and practices among health workers and community members on anaemia were obtained through a cross-sectional study in the intervention and control areas in October 2000. The study areas were among the sentinel districts for anaemia surveillance. The intervention area was randomly selected among those districts where health and nutrition training was provided to the health workers. The control area was selected from the areas where no health and nutrition training was instituted to the health workers. Control area had similar socioeconomic and geographical characteristics with the intervention area.

Results: Anaemia was highly prevalent in the two study population in both areas, the intervention area having significantly higher prevalence (82%) than the control area (76%) in under five children ($p = 0.028$). A similar trend was observed in pregnant women, 75 percent being anaemic in the intervention area as opposed to 72 percent in the control area but the difference between the two areas was not significant. For both groups prevalence of anaemia was observed to be high in May than in November ($p < 0.001$).

Regarding knowledge, health workers and respondents at household level in the intervention area had higher knowledge than in the control area. However, the percentage of respondents with good knowledge was very low. Although there was some improved practices in the intervention area, it did not reflect the knowledge improvement as compared to the control area. Dietary practices

favorable to prevent anaemia were found to be more in the control area than in the intervention area. Staples were the food group regularly consumed by the majority in both areas at household level than any other food groups.

Conclusion: Findings of this study indicate that the observed high prevalence of anaemia in the intervention area may partly be explained by lack of good knowledge on anaemia among the majority of health workers. Further, this may have lead to poor practices for the prevention and control of anaemia at community level. Therefore, there is a need for reviewing the health and nutrition training programme so that its future implementation can bring desirable change through improved knowledge among the health workers, involvement of policy makers and active cooperation of the community members.

KEY WORDS: anaemia, iron deficiency anaemia, health and nutrition education, knowledge, attitudes and practices, health workers, Tanzania.

Acknowledgement

My sincere gratitude goes to Dr. Akhtar Hussain my main supervisor, Dr. Kagoma S. Mnyika my co-supervisor for their valuable time and support they gave me through the whole process of laying grounds for this study until its accomplishment. Akhtar, your patience, encouragement and constructive criticism gave me the courage to go through the mentoring process. Mnyika, your close supervision during preparation for the fieldwork is highly appreciated despite of hardship of financial constrain, you made me go through it.

My gratitude also goes to Prof. Knut-Inge Klepp for taking his time to go through my initial preparatory work and advice and Dr. John-Arne Røttingen and Prof. Odd Aalen for introducing me to the world of statistical niche.

Special appreciation is expressed to the management of Tanzania Food and Nutrition Centre and especially the Managing Director Dr. W. Lorri for financial and other logistic support of which this study would not have been possible without their due support.

I also wish to thank my TFNCs companions especially Dr. S. Tatala, Monica Ngonyani, Lawrence Mselle, E. Nyang'ali, D. Ruhiye, V. Mambosho, J. Kitali, and I. Manyama for their continued support during the initial stage of my proposal development, and

preparation for the field work. Your input has been really valuable. This goes without forgetting my colleagues at the Institute of General Practice and Community Medicine, Tapiwa Kebalepile from Botswana, Fabian Ndenzako from Tanzania, Suraji Thapa from Nepal and Fadinding Manneh from The Gambia, you have been so helpful and your rescue was always timely.

Many thanks goes to the district officials and in particular district medical officers Dr. Mremi of Iramba district and Dr. Ng'ingo of Kondoa district for allowing me to carryout the study and logistic support they offered me. I wish to express my sincere gratitude to Dorothy Kinswaga, Margreth Simon, Magdalena Magingi and Rashid Mhina who made data collection possible. You had tireless long working hours, skipping your lunch for so many days, your courage and kindness is highly appreciated.

To all academic staff of the department of International Community Health, your academic and social support, and for making us feel at home for the evenings we spent together at your homes for the dinner, your hospitality will always be remembered.

I owe special thanks to all health workers, Ward Executive Officers, Village Executive officers and community members and individuals in Iramba and Kondoa for giving us their valuable time and support in this study.

This study programme would not have been possible without the financial assistance from the Norwegian government through the quota programme, to which I feel indebted.

Lastly, but not the least to the driver Hamad Mbamba during the field survey, you worked hard driving us to and from the survey sites from dawn to late evenings despite the mechanical problems we had with the car, keep it up. And to all those who have not been mentioned but participated in one way or another, I would like to extend my sincere gratitude to them all.

Dedication

To my mom Elitha and my dad Rodrick for giving me
the opportunity to go to school. My wife Yokebeth for assuming all the responsibilities during my absence and lastly, to my son Erick, you had to do without your dad for so long, I adore you all.

List of acronyms

ACC/SCN	- Administrative Committee on Coordination/Sub-committee on Nutrition
EDP	- Essential Drug Programme
EFNEP	- Expanded Food and Nutrition Program
FAO	- Food and Agricultural Organization
HESAWA	- Health, Environmental Sanitation and Water
Hgb (Hb)	- Haemoglobin
IDA	- Iron deficiency anaemia
IDD	- Iodine Deficiency Disorders
IEC	- Information, education and Information
MCH	- Maternal and Child Health
MI	- Micronutrient Initiative
MoH	- Ministry of Health
MORLAG	- Ministry of Regional Administration and Local Governments
NASS	- National Anaemia Surveillance System
NNACP	- National Anaemia Control Programme
PCD	- Partnership for Child Development
PEM	- Protein Energy Malnutrition
PHC	- Primary Health Care
SPSS	- Statistical Package for Social Sciences
TDHS	- Tanzania Demographic Health Survey

TFNC - Tanzania Food and Nutrition Centre

UMATI - *Uzazi na Malezi Bora Tanzania* (Family Planning Association of Tanzania)

UNICEF - United Nations Children's Fund

UNU - United Nations University

UPE - Universal Primary Education

URT - United Republic of Tanzania

WHO - World Health Organization

χ^2 - Chi square value

Introduction

Global situation

Nutritional anaemia resulting from iron deficiency is the world most prevalent nutritional problem (Szarfarc and de Souza, 1997). It affects hundreds of millions of people all over the world with the highest prevalence among young children and women of childbearing age and particularly pregnant women. There is overwhelming evidence that it has a serious impact on human development, on the formation of human capital and on the social and economic development of most countries (ACC/SCN, 1997). Poverty is the basic cause in developing countries depriving people of resources to satisfy their basic needs such as education, food and nutrition. Likewise, lack of access to health care, safe water and sanitation leading to increased rates of infections are some of the underlying causes of anaemia (Magambo *et al*, 1998; WHO/ICO/MESD, 1995).

It is estimated that nearly 2 billion people worldwide in both developed and developing countries suffer from anaemia with the highest prevalence being in Sub-Saharan Africa (West, 1997; WHO, 1997). The prevalence tends to vary according to geographical areas. In Eastern and Southern Africa the prevalence ranges from 47 percent to 56 percent in most countries while in South Central Asia anaemia prevalence is as high as 75 percent (ACC/SCN, 2000).

Anaemia in children

Infants and children are primarily affected by iron deficiency in the world because of higher iron requirement related to rapid growth and diets that are relatively low in iron content (Booth and Aukett, 1997; Hassan *et al*, 1997). Other causes such as malaria in malaria endemic areas and inappropriate feeding practices play a role in anaemia causation (UNICEF/WHO, 1999). It is estimated that about 31 percent of children below five years of age in developing countries are anaemic (WHO, 1999). The sequelae of iron deficiency anaemia in infancy or childhood include significant loss of cognitive abilities and reduced resistance to infection. It also has adverse consequence on growth, physical fitness and mental function thus leading to their poor scholastic performance (Howson *et al*, 1998; ACC/SCN, 1991).

Anaemia in women

Women in their reproductive years have a particular high demand for haemopoiteic nutrients. During pregnancy, iron requirements exceed storage iron for most women. The increased need by the body for iron is due to increase in the red cell mass iron needs of the fetus and iron losses during delivery (WHO, 1992). In non-pregnant state or during lactation, regular menstrual losses, malaria and parasitic infestation such as hookworm are also important causes (*Ibid*.). In Sub-Saharan Africa an estimated 42 percent of women aged 15 to 45 years are anaemic with a prevalence of more than 50 percent during pregnancy. Anaemia in women of childbearing age is associated with an increased risk of complications during pregnancy such as; abortions, premature deliveries, low birth weight and causes infants to enter life with sub-optimal iron stores (FAO; 1997a).

Anaemia in other groups

Adolescents and sickle cell patients are among those at risk for anaemia. Changes associated with puberty such as increased growth of the body tissues and hence of the body mass in boys and menarche in girls make them more vulnerable (Milman *et al*, 1999). Sickle cell patients are at increased risk due to repeated sequestration of the red blood cells and other crisis during their lifetime. However, folic acid deficiency is the main problem rather than iron deficiency.

Anaemia in the elderly though hasn't attracted much attention, is significantly high. Some studies (Izaks *et al*, 1999) have demonstrated association of increased mortality risk in the elderly due to anaemia. Generally, anaemia in adults reduces their working capacity both physically and mentally (Howson *et al*, 1998; FAO, 1997a).

Intervention strategies

Intervention strategies for improving iron status are basically grouped into two. These are the food-based strategies, which include fortification of foods with micronutrients and dietary diversification to increase production and consumption of foods rich in iron, vitamin C and folate. Supplementation with specific micronutrient to the vulnerable

groups and public health measures to control diseases especially malaria and worm infestations are the non-food based strategies (Gillespie, 1998; Vijayaraghavan, 1995). Health and nutrition education to improve and ensure regular consumption of foods rich in iron, folate and vitamin C and to reduce consumption of interfering substances is also important for the prevention and control of anaemia.

Although these strategies have been in operation for over two decades, there has been no perceptible biological impact on the prevalence of iron deficiency anaemia. Among the constraints, the most important are; lack of co-ordination, lack of proper orientation and training to the functionaries, poor monitoring and supervision and absence of health and nutrition education (Vijayaraghavan, 1990).

Micronutrient supplementation involves provision of high dose preparation of a nutrient to vulnerable groups for developing anaemia. These groups are infants and young children, pregnant and non-pregnant women, and adolescent girls. This form of intervention is regarded as a short-term measure as has shown to be effective in controlling anaemia when distribution, coverage and compliance are high (Gillespie, 1998).

This strategy has not been successful in reaching the target audience due to a number of reasons (Gillespie, 1998; Viteri, 1998), which are important to be addressed in health and nutrition education. These reasons include lack of political will and programme support, inadequate awareness of the seriousness and magnitude of the problem and poor compliance with the taking of iron supplements. Furthermore, the most vulnerable are hardly reached and iron supplementation is still an ongoing process.

As mentioned in the 4th report on the Worlds Nutrition Situation by ACC/SCN (2000), success of the oral iron supplementation is dependent on many factors. These factors relate to the distribution and accessibility of supplement supplies, compliance in taking or giving the supplements according to the protocols and the available strategies for raising awareness among the health workers and the community. Intersectoral and multidisciplinary collaboration together with community participation and ownership are among factors that influence success of iron supplementation programs.

Dietary diversification is a major long-term solution for the control of micronutrient deficiencies, especially iron deficiency. It is a strategy for improving either the amount of food-iron ingested in the diet or its bioavailability (FAO, 1997b). The main stay of this control strategy has been promotion of production and use of foods rich in iron, vitamin C and folic acid. Dietary iron availability can also be improved by better choices of food purchased, meal composition, distribution of food to family members (Treiman *et al*, 1996) and food processing techniques (Bui *et al*, 1999).

Dietary diversification involves encouraging people to eat micronutrient rich foods. It is important therefore, for programmes to provide information on plant and animal sources of micronutrients, home gardens featuring micronutrients rich plants, and teach food preservation, processing, and preparation techniques that retain nutrients. This has a remarkable impact in influencing lifestyle patterns related to dietary intake.

Fortification of common foods with essential nutrient is another strategy that aims at improving and sustaining iron nutrition on a permanent basis. It was long considered as a medium-term approach in areas where micronutrients are not naturally available, but based on its success in industrialized countries, it is now considered as a long-term intervention (ACC/SCN, 1997).

Although food fortification with iron is now recommended to be used much more extensively in the developing world (UNICEF/UNU/WHO/MI, 1999), its use is still limited. Most developing countries do not satisfy the criteria for the fortification programmes. Such criteria include lack of suitable vehicles for the fortificant, lack of large-scale central processing units and irregular consumption patterns. The irregular consumption pattern is often related to social economic status hence the fortified food being consumed by a smaller proportion of the population.

Strong communication and advocacy component is needed to raise consumers' awareness and apart from focusing on the problem, its consequences and means of addressing IDA, the use of all the available media for social communication is very important at this stage.

Public health measures include control of diseases that are associated with chronic blood loss hence leading to iron deficiency and anaemia. These diseases include intestinal parasites and especially hookworms. In areas where hookworm is endemic, deworming programmes have shown to improve iron status as well as moderate to severe anaemia (Stoltzfus *et al*, 1998). Public health measures include prevention of other diseases such as acute respiratory infections, malaria and diarrhoeal diseases, which are often associated with loss of appetite leading to poor feeding and loss of nutrients through diarrhoea.

Deworming alone is not sufficient to improve the iron status especially where causes of iron deficiency are multiple. Stoltzfus *et al* (1998) demonstrated that deworming did not significantly improve the mean haemoglobin nor did it reduce the prevalence of anaemia relative to the control group. Thus, control of diseases such as deworming should be strongly linked to other interventions that increase iron intake like fortification and supplementation.

Public health measure as a strategy can be accomplished by advocating a variety of measures. These include importance of early and adequate treatment, control of diseases through immunization against infectious diseases, environmental sanitation, deworming and malarial control. These measures if properly implemented, have shown to have an effect in reducing the prevalence of anaemia (Albonico and Saviol, 1997; Stoltzfus *et al*, 1997a).

Health and nutrition education

This is the core of all preventive and control measures. Health and nutrition education is said to bring about change once instituted correctly (Ulmi *et al*, 1999). Lack of

knowledge, beliefs about foods, customs and poverty are the main factors preventing many people from eating enough micronutrient-rich foods (Torres, 1995).

Nutrition education is concerned with modifying social communication to bring about short or long-term changes in the common behaviour that affects the knowledge, attitude and practice on nutrition related issues of the population (Treiman *et al*, 1996; Andrien, 1994). It can be effective in changing behaviour when changing behaviour, rather than disseminating information is the clear intention of the program (Cerquira, 1995). Therefore, behavioural change is the ultimate criterion for effective nutrition education.

Among the constraints to the implementation of activities for anaemia control at primary health care level include lack of knowledge and awareness of anaemia as a health problem among health care providers and the community (Massawe *et al*, 1999). Hence the need to integrate health and nutrition education activities so that both health provides and the community are made aware of the problems of anaemia and measures to take on prevention and control.

The major challenge with health and nutrition education is what happens after the provision of health and nutrition education. Do people retain knowledge gained and change their food-related behaviour? Brink *et al*, (1994) demonstrated that participants tend to change nutrition knowledge and dietary practices while they are involved in the programme. However, with time participant's behavior and nutrition knowledge decreases, which indicate that without constant stimulation, the knowledge gained tends to fade away with time.

Health and nutrition education can achieve everlasting changes on nutrition knowledge and practices (Manios *et al*, 1999; Brink *et al*, 1994; Anliker *et al*, 1993 and Sorensen *et al*, 1992). To be effective, projects must be based on a thorough study of behaviours, attitudes and the practices of the social groups concerned.

A considerable effort must be made in the field of communication. Only multimedia strategies, utilizing several chapels of communication, can meet such a formidable challenge. This can be achieved by involving people from different areas including education, communication, agriculture, horticulture, public health and nutrition. It should focus on creating and raising awareness on the causes of anaemia, its consequences and preventive measures in the community.

The complexities of the causes of nutritional anaemia are varied and so are the intervention strategies. Despite the fact that much is known about the intervention strategies for the prevention and control of IDA for successful implementation, health and nutritional education remains the key strategy for health promotion and disease prevention. The multimix of this strategy has not been successfully implemented to bring about change in knowledge, attitudes, behaviours and practices related to IDA prevention and control.

Health in Tanzania

Good health has been recognised as a major resource for social and economic development of the country since independence in 1961. The evolution of the health sector in Tanzania is reflected by the change of the objectives of the first (1969-1974), second (1969-1974) and the third (1976-1981) five-year development plans.

The objectives relating to health in the first five year development plan, was to be self sufficient in health personnel, to increase the per capita income of the population and to increase life expectancy from 35/40 years to 50 years. Emphasis in this plan was basically on curative services (URT, National Health Policy, 1990).

The second five-year development plan observed a step further towards preventive services to curb the spread of communicable diseases. However, a major step was realised during the third five-year plan where the objectives were to provide clean water, health services in both rural and urban areas and the establishment of the Universal

Primary Education (UPE) programme. These objectives were vital in the implementation of the Primary Health Care (PHC).

During this third five-year plan, the government gave priority to environmental sanitation, good nutrition, construction of rural health facilities, expansion and strengthening of preventive services. It also gave priority on the provision of primary and adult education and distribution of health education materials.

This marked a new era of multi-sectoral co-operation in the implementation of PHC. Maternal and Child Health services (MCH) started to be conducted in all health facilities. The clinics apart from carrying out vaccinations and family planning service they also provided health and nutrition education.

Within this context, success has been recorded in the reduction of morbidity and mortality due to vaccinations. In 1988 vaccination coverage was estimated at 85 percent of the immunizable diseases. Other achievement include a rise in the life expectancy from 35 years in 1964 to 52 years in 1984 and reduction in the infant mortality rate of 215 per 1,000 in 1961 to 93 per 1000. There has also been a decrease in under five mortality rate from 211 per 1,000 in 1980 to 144 per 1000. The maternal mortality ratio has remained high at 530 per 100,000 (UNICEF, 1998).

Regarding malnutrition in Tanzania, data available indicate that 28 percent of the total population suffer from protein energy malnutrition (PEM), 32 percent from anaemia, 41 percent from iodine deficiency disorders (IDD), while 6.1 percent are vitamin A deficient (Kavishe, 1993).

According to Demographic and Health Survey reports (TDHS, 1996) on childhood nutrition status, 43 percent of under five children in Tanzania are classified as stunted, and 18 percent are severely stunted. For wasting, overall 7 percent of children below five years are wasted while 1 percent is classified as severely wasted. As for underweight,

more than 31 percent of under five children are underweight for their age, which may reflect stunting, wasting or both.

Anaemia in Tanzania

Anaemia is highly prevalent affecting about 32 percent (Hb<10 g/dl) of the total population as a result of various causes at different levels (Kavishe, 1993). It is the most common nutritional disorder and the most common cause of nutritional anaemia in young children and women of reproductive age. Up to 45 percent of children below five years and 80 percent of pregnant women are anaemic. The available information from hospital based data; anaemia is responsible for a significant amount of morbidity and mortality in the country. Of the admitted under five children, anaemia is responsible for 20 to 80 percent and for 18 to over 87 percent of the admitted pregnant women. Anaemia directly contributes to 5 percent of maternal mortality and plays an underlying cause in 63 to 73 percent of maternal deaths (Mnyika, 1991).

The distribution of anaemia in the country seems to follow a geographical pattern, which is determined by altitude and diseases. The problem is more serious in the coastal belt and other low altitude areas and decreases as the altitude increases above 3000 meters. For example, studies done in Lindi region (Tatala, 1998), which is a low altitude area, anaemia, affected 84 percent and 67 percent of pre-school and school aged children, respectively. The geographical pattern is also associated with other factors such as sickle cell disease, the low bio-availability of iron from cereal based food sources and the effect of parasitic infections like malaria, intestinal worms and schistosomiasis (Kavishe, 1993).

Regarding causes of anaemia in the country, low intake of iron, poor bioavailability of dietary iron, infections and parasitic infestations are the major determinants of individual iron status (Tatala, 1998; Kavishe, 1993). The important factors found to be contributing to the inadequate diet to under five children include inadequate breast feeding and weaning practices, absence of exclusive breast feeding, low feeding frequency for the weaned babies and early weaning. Parasitic infestations are also common among the pre-school and school aged children (Tatala *et al*, 1996).

Control of anaemia in Tanzania

Activities for prevention and control of anaemia have been largely based on the pharmaceutical approach through supplementation of iron and folic acid tablets to pregnant women through the essential drug programme (EDP). However, there are several other programmes, which although not specifically stated in their objectives, will ultimately have an impact on reduction of anaemia. These include the national programmes for the control of malaria and schistosomiasis, MCH programmes, the UMATI (Family Planning Association of Tanzania) parasite control and nutrition; and the Health, Water and Sanitation programme (HESAWA).

Despite of the supplementation programmes being existent for more than a decade, information from the spot surveys and hospital-based data does not indicate any significant improvement in the problem of anaemia (TFNC, 1991a). The high prevalence of anaemia in the country, therefore, necessitated the introduction of an intervention programme for the control of anaemia in 1982 of which it became more active in 1991.

The major activities being implemented by the national programme for the control and prevention of anaemia (NACP) are; promotion of breast feeding practices and weaning food development, promotion of production and consumption of horticultural products especially fruits and vegetables rich in vitamin C and iron. Other activities include supplementation of iron and folic acid to pregnant women, control of anaemia related diseases especially intestinal helminth (hookworm and schistosomiasis) and malaria, feasibility studies on food fortification with iron and nutrition education campaigns.

One of the objectives of NACP as stipulated in its five-year plan (1991-95) was to create awareness and increase knowledge of the problem of anaemia and ways of its control at all levels (TFNC, 1991b).

Among the strategies, which the NACP has been using to address the problem of anaemia in the community, has been to raise awareness and increase the knowledge on the causes

and consequences of anaemia and ways of its control among health workers through anaemia training workshops. By January 2000, health workers from 24 districts out of 103 districts of the mainland Tanzania were already trained on anaemia.

Training focused on the nature of the problem, manifestations and effects of anaemia. It also covered aspects of prevention and control measures including control of malaria, worm infestations like hookworms and schistosomiasis. The promotion of production and use of foods rich in iron, folate and vitamin C through horticulture, and small animal husbandry were also covered (TFNC, 1995). More emphasis was put on the importance of supplementation especially to the vulnerable groups like preterm babies, low birth weight babies, pregnant women and sicklers.

To complement the intervention efforts and with the difficulties in monitoring the trend of anaemia in the communities throughout the country, a national anaemia surveillance system (NASS) was established in 1997. Twenty-five district hospitals from mainland Tanzania were chosen as sentinel centres (annex 5). This system is aimed at generating anaemia data from the selected sentinel centres for a continuous process of assessing and watching over the state of anaemia in the community all over the country. The purpose is to monitor the trend of anaemia and thus provide necessary feedback to the programme for decision making.

These sentinel centres carry out data collection on anaemia of pregnant women and children below five years of age attending mother and child health (MCH) clinics for routine check-up.

A reporting system was developed, where haemoglobin levels of children below five years of age and of pregnant women attending MCH services are estimated by cyanomethaemoglobin method and recorded in g/dl. Data is collected twice a year during the month of May and November. Haemoglobin measurements and collection of data take place every clinic day from the first to the last day of the month. The definition of anaemia is based on the WHO cut off points for the age and sex groups

(WHO/UNICEF/UNU, 1996). The age, sex and in addition parity for the pregnant women were also recorded.

Since there has been no evaluation done to assess the health and nutrition training programme among the health workers from the time it was initiated, a cross section study was therefore, designed to examine the outcome of the intervention on anaemia in the community.

Objectives of the study

The overall objective was to assess the effect of health and nutritional anaemia training among health workers on anaemia prevention activities in their respective rural communities of Tanzania.

The specific objectives addressed in this study were to assess the:

- status of anaemia prevalence in children below five years and pregnant women in an intervention and a control district following health and nutritional anaemia training programme (Paper I).

- *knowledge and practices of the health workers in the two districts in relation to their activities for the prevention of anaemia (Paper II).*

- community members' knowledge, attitude and practices in relation to the occurrence of anaemia in the two districts (Paper II).

Materials and methods

Study design and study areas

The study was a cross-section in design conducted in the rural areas of Iramba and Kondoa districts in October 2000. The two districts are located in the central part of the mainland Tanzania and they belong to two bordering regions (annex 2 a & b). These regions are Singida (for Iramba) and Dodoma (for Kondoa). The health workers and households members were interviewed to collect information regarding the problem of anaemia in relation to knowledge, attitudes and practices.

Iramba district lies between latitude 3.5 degrees south of the Equator and longitude 34.35 east of Greenwich. The district has an area of 7,900 sq. km. with an estimated population from the population projection of 1988 census of 395,716 people. The main tribes of the district are Nyiramba and Nyisanzu. Others are Barbaig, Hadzabe, Taturu, Sukuma, Kimbu and Nyaturu. Food crops grown are sorghum, maize, bulrush millet, paddy cassava, beans and cow peas. The district has 7 divisions, 26 wards and 118 villages. It is served by 2 hospitals, 4 health centres and 51 dispensaries. Iramba receives a mean annual rainfall of 500-850 mm, it has an average annual temperature of 21°C -27°C. Major physical features include Wembere plains, Central plateau and Eastern zone (URT, 1997a).

Kondoa district is located between latitude 4º 12' south of Equator and longitude 35º 6' east of Greenwich, and covers 13,209 sq. km. of land. The estimated population is 459,227 of which, 242,931 are females and 216,296 are males. The Rangis are the main ethnic groups in this district. Others are minority, which include Waasi, Wasandawe, and Wafiomi. The main crops grown are sorghum, maize, bulrush millet and sunflower. Administratively, the district has 8 divisions, 32 wards and 175 villages. With respect to health services, the district has a total of 58 health facilities, which include 1 hospital, 4 health centres and 53 dispensaries. The district receives an average rainfall of 500-800 mm in a year and an annual temperature of 21°C (URT, 1997b).

Selection of the study areas

The study areas (Iramba and Kondoa) were selected among the 25 sentinel districts for anaemia surveillance in the mainland Tanzania. Iramba district which, was the

intervention area (IA) for nutritional anaemia, was randomly chosen among the 13 districts from which health workers had undergone training on nutritional anaemia. The district was selected following the inclusion criteria of at least 3 haemoglobin observations of 6 months apart for children and pregnant women, and an initial prevalence of anaemia (from the 1st anaemia surveillance data) of more than 60 percent for both children and pregnant women. Only Iramba district satisfied the inclusion criteria.

Table 1: Descriptive presentation of the study areas

	IA*	CA†
Divisions	7	8
Wards	26	32
Villages (Total)	118	175
Villages visited	23	25
Households visited	319	322
Health facilities (Total)	57	58
hospitals	2	1
health centre	4	4
dispensaries	51	53
Health facilities visited	28	35
Health workers (Total)	299	214
Health workers interviewed	97	104

*IA - Intervention Area
†CA - Control Area

Kondoa district was selected as control area (CA) from 12 sentinel districts for anaemia surveillance in which training on nutritional anaemia was not provided to the health workers. The district was selected in order to secure comparability with the IA in terms of socio-economic and demographic characteristics. The procedure was adopted since we could only include one district among the sentinel districts due to time limitation for the master thesis.

Sampling frame

Health workers from rural health facilities and representatives from the households in the selected villages constituted the sampling frame.

Study population

Health workers from 28 and 35 rural health facilities in the intervention area (IA) and control area (CA) formed the study population. Selection of health facilities was done in such a way that almost every ward in each district was represented. Four health workers were to be interviewed in each health facility. However, most of the rural health facilities had very few health workers of less than 3, therefore, interviews were conducted to all health workers found at the health facility on the day of interview. In total 97 health worker in the IA and 104 in the CA were interviewed.

Selection of villages followed the health facilities visited except in the wards that had more than one health facility, where only one village was visited. With the help of village leaders, households were grouped based on the ten cell leaders in each hamlet. A random selection was performed to have 7 households in each hamlet from a list of households having at least one child below five years.

The study population therefore, included respondents (who could be a father, a mother or caretaker) from 319 households drawn from 23 villages in the IA and from the CA 322 households were visited in 25 villages.

Respondents from the households were interviewed on knowledge, attitudes and practices regarding the problem of anaemia and its prevention and control measures.

Sample size

Calculation of the sample size was based on the initial prevalence of anaemia of 70 percent reported from the surveillance sites in 1997. The significance level was set at 0.05 and a power of 80 percent to detect a reduction of anaemia by 15 percent. The sample size was 320. Addition at 10 percent was calculated to compensate dropouts and refusal to participate; the sample size was then 352 from each district. The response rate was 91 percent for both Iramba and Kondoa districts.

Data collection

Questionnaire based interviews

There were two sets of open-ended questionnaire used to collect data, one for the health workers and another for the community members at household's level. Questions were formulated to address issues related to knowledge, attitude and practice regarding the problem of anaemia and its prevention.

The questions were divided to address four major issues. The first part covered demographic characteristics including age, gender and education. For the health workers it also included cadre of staff, work experience and anaemia training, while for the households' marital status, occupation and socioeconomic status were also included.

The second part included knowledge on the causes, effects, prevention and control measures for anaemia especially control of diseases and foods that are important in blood formation in the body. Issues related to supplementation and breast-feeding in relation to anaemia were also part of the health workers questionnaire.

Thirdly, attitudes among the household's respondents on supplementation, use of food, fruits and vegetables to prevent anaemia and role of nutritional meetings to prevent and control anaemia was included.

Lastly, practices on prescribing and dispensing of iron and folic acid tablets to the vulnerable groups, provision of health and nutrition education, prevention and control of malaria and hookworm and dietary diversification efforts were part of the health workers questionnaire. In the household questionnaire, practices included food consumption pattern, sanitation, home yard gardening and animal husbandry. At household level observation regarding sanitation and home yard gardening was also done.

The questionnaires were translated and administered in Swahili, which is the national language after being pretested. The interviews were conducted and the questionnaire filled in by 3 health personnel who were trained in interviewing techniques before the study commenced.

The interview, which lasted for 20-30 minutes, took place in the health facilities for the health workers and in the homes of those households selected from the community. At the end of each day, the filled in questionnaires were crosschecked and any observed mistakes were rectified.

Laboratory methods:

Data on haemoglobin:

Secondary data for haemoglobin levels for children below five years and pregnant women for the IA and CA were obtained from Tanzania Food and Nutrition Centre (TFNC) data bank. Normally data is collected twice yearly, in May and November through the anaemia surveillance system. Data used in this study was collected in May and November for the period starting from November 1997 to November 1998.

Haemoglobin measurements

Cyanomethaemoglobin method was used to determine the Hgb concentration in the sentinel laboratory (Jenway colorimeter, Model 6030, UK). This method consists of drabkins solution, a cyanomethaemoglobin standard, micropipettes and test tubes of 5-10 mls. Using disposable lancets, a finger-prick is done, and blood samples collected in a disposable micropipette. Thereafter 5 mls of drabkins solution is mixed with 0.02 mls of blood. Hemoglobin is oxidized to methaemoglobin by ferricyanide. The methaemoglobin is then converted to the stable cyanomethaemoglobin by addition of potassium cyanide. The absorbency of cyanomethaemoglobin is measured at 540 nm and results recorded as Hgb in gm/dl.

Piloting of the data collection tool

Pre-testing of the tool was done in two health facilities and two villages for the purpose of ascertaining the sustainability of the questions in the local cultural setting. Evaluation was done on the content and flow of the questions and answers, acceptance, validity of

the answers and time needed to complete the interview. Thereafter, the content and flow of the questions were modified and rearranged accordingly to facilitate easy comprehension.

Data analysis

Statistical Package for Social Sciences (SPSS) 9.0 for WINDOWS was used to analyse the data. A χ^2- test was used to analyse categorical variables for the difference. For continuous variables, student t-test was applied. Significance level was accepted when $p < 0.05$ and all p-values presented are two-tailed.

Regarding anaemia, analysis was performed to give severity according to WHO cut-off point of 11 gm/dl for under five children and pregnant women (WHO/UNICEF/UNU, 1996). Responses on knowledge and practice for the health workers and at household level were standardized to give each option equal weight. The assessment was based on a 3 point scale of 1, 2 and 3, which later were categorised as 1 having good, 2 moderate and 3 low knowledge and practice, respectively. The categories were: those who answered more than 2/3 of the options scored good, 1/3 to 2/3 of the options scored moderate while those who answered less than 1/3 of the options scored low.

Dietary assessment based on 7 days recall was analysed based on a 5-point scale of a single food item in each food group. For interpretation, the 5-point scale was reclassified and categorised into regular consumer, occasional consumer and never consumed. Regular consumers were those who consumed one or more of the food items in a particular food group once or more in a day. Occasional consumers were those who consumed any of the food items in a food category once to 6 times in a week. The 3rd category included those who never consumed any of the food items.

Ethical issues

The Tanzania Food and Nutrition Centre (TFNC) Research and Ethics committee and The Norwegian Ethical Committee for Medical Research approved the study protocol. Informed consent was sought from the representatives of the communities and the

selected households for the study. Verbal explanation was provided to the incharge of the health facility and the head of the household of the purpose and procedure of the study prior to the interview. Refusal of individuals to participate in the study was respected. Further, participants were informed that they might withdraw from the study at any stage.

Limitation of the study

Study design

The study was a cross-sectional in design. Cross-sectional studies are studies in which individuals are observed only once. The procedure has an inherent weakness that the temporal relationships between events and the associated factors cannot be determined. Therefore, it is difficult to infer particular cause-effect relationship in this context. The credibility of such inferences would therefore have to rely on the strength of the theoretical argument advanced.

Findings on knowledge, attitudes or practices in this study should therefore be interpreted with caution. Anthropological studies would have strengthened observed associations. However, given the situation of limited resources and time, cross-sectional studies are preferred.

Study population

Haemoglobin levels were taken at the sentinel district hospitals. Therefore, the results may only reflect a small segment of the population i.e. for only those who have come to the hospital. The district hospital most often acts as a referral hospital in rural settings, therefore, some people may come outside the catchment area to which the district serves and hence dilute the strengths of associations.

Use of secondary data

The use of secondary data (haemoglobin levels) could not permit analysis of associations between variables of interest and anemia prevalence because it could not be linked directly to the primary data on knowledge, attitudes and practices at household level.

Furthermore, some variables were not included during the time of haemoglobin measurement. For example age for pregnant women were not recorded.

Inconsistency of data registration and lack of data for the year 1999 and 2000 from the intervention area has limited the interpretation of the results since the number of subjects were few on the preceding years and the analysis was only performed for the year 1997 and 1998 only. In order to observe a trend over time observations or data collection for a longer period would have been more appropriate.

Haemoglobin measuring technique

The cyanomethaemoglobin method for measuring haemoglobin (Jenway colorimeter, UK) is rather cumbersome unlike HaemoCue system, which measures haemoglobin concentration within seconds from a drop of whole blood without any need of electricity. Therefore, technical errors are more likely to occur when using cyanomethaemoglobin method and thus influence the results.

Lack of baseline information

At the beginning of the health and nutrition training programme there was no baseline data for the knowledge, attitudes and practices. In the absence of a baseline data difficulties may arise in interpreting the results. A control area was therefore included in this study to minimize difficulties, which might have occurred during the interpretation of the results. Therefore, natural changes in knowledge, attitudes and practices may not have been observed.

Since the distribution of health facilities and villages visited covered almost all the districts, the results of this study can therefore, be generalized to other districts as well. Despite of the limitations outlined above, the findings obtained in this study we think can still reflect what is happening in these populations.

SUMMARY OF RESULTS

PAPER I

Using anaemia prevalence as a proxy in assessing the effectivity of anaemia training programme among health workers.

This paper examines whether the prevalence of anaemia had changed among under five children and pregnant women following health and nutrition education intervention to the health workers in an intervention area as compared to the control area. The report is based on secondary data on haemoglobin levels for the under five children and pregnant women submitted from the intervention and the control areas through the established anaemia surveillance system. Data included for the study were for the months of November 1997, May and November 1998.

To allow comparability with other studies, definition of anaemia for the two groups was based on the WHO cut-off point of haemoglobin less than 11 g/dl.

Of the 241 under five children, 175 (73%) were found to be anaemic in the intervention area (IA) while in the control area (CA) 79 (72%) out of 110 children were also anaemic in the year 1997. The prevalence increased in 1998 where 334 (89%) of the 377 under five children in the IA and 163 (79%) of the 207 in the CA were anaemic. In the IA there was no gender difference in the prevalence of anaemia (82%) while in the CA 74 percent of boys and 76 percent of girls under five were anaemic.

The increasing and decreasing tendency in the prevalence remained the same in the two areas regardless of age. However, the prevalence remained high although older children had lower prevalence. The prevalence in 1998 was much higher in the IA ($p < 0.001$) than in the CA ($p=0.167$) compared to 1997 data.

For the pregnant women 53 (68%) of the 78 and 142 (72%) of the 196 pregnant women were anaemic in the IA and CA in 1997, respectively. In 1998 the IA had 39 (80%) of 49 pregnant women were anaemic while in the CA there were 192 pregnant women of which 148 (77%) were also anaemic. The prevalence in 1998 was therefore higher than in 1997.

With respect to parity in 1997, the prevalence was high among pregnant women who had delivered four times and above in the CA. However, the trend remained the same for 1998. With regard to gestation, women who were 25 weeks and above had lower prevalence of anaemia than those who were less than 25 weeks of gestation. This phenomenon was observed in both areas. However, the prevalence levels though high in both areas, the CA had relatively lower than the IA.

PAPER II

Health workers and community members' knowledge, attitudes and practices on anaemia as a consequence of training among health workers in Tanzania.

The objective of the study was to examine whether there was a difference in the knowledge, attitudes and practices towards the problem of anaemia among health workers and community member's in the intervention area (IA) as compared to the control area (CA). Data on knowledge, attitudes and practices and socio-demographic variables were collected by direct personal interviews. Food consumption pattern based on 7 days recall was also collected through household's interviews.

Interviews were conducted with 97 health workers and 319 household members in the IA while in the CA there were 104 health workers and 322 household representatives who participated in the study.

The mean age for health workers was 39.1 ± 6.2 in the IA and 38.7 ± 7.1 in the CA. Females had lower mean age than males. For the households females constituted the majority about 80 percent of the interviewee in both areas. Mean age by gender shows that females had lower mean age than males, 30.7 ± 8.8 for females and 40.2 ± 11.3 for males in the IA; and for the CA females had mean age of 31.7 ± 9.5 and males 38.5 ± 11.4.

Regarding occupation at household level, subsistence farmers constituted 86 percent in the IA and 92 percent in the CA. Males were more literate than females in both areas. In the IA 81 percent of male and 76 percent of females were literate as compared to 77 percent of males and 72 percent of females who were literate in the CA. Majority were married couples about 85 percent in both areas with a mean household family size of 5.9 ± 2.4 for the IA and 6.1 ± 2.5 for the CA. The CA was economically better than the IA.

Regarding knowledge, less than 20 percent of the health workers had good knowledge in most areas related to anaemia. The IA had slightly higher proportions of health workers who had good knowledge than in the CA. At the household level, a majority of the respondents from both areas had moderate knowledge on anaemia. On practice, health workers in the CA had more desirable practice than in the IA while at the household

level, majority of the respondents in the IA demonstrated good practices with regards to the prevention of anaemia. The majority of the respondents in the IA had positive attitudes to food, supplementation, eating green leafy vegetables for preventing anaemia.

For the food consumption pattern, staples were the foods regularly consumed by the majority, 88 percent in the IA and 98 percent in the CA followed by foods of animal origin where 33 percent were regular consumers in the IA and 53 percent in the CA. The least regularly consumed food group was the leguminous products where 8 percent in the IA and 27 percent in the CA regularly consumed the item.

GENERAL DISCUSSION

The overall objective of the study was to assess the effectiveness of health and nutrition training on anaemia among the health workers. In addition changes in the knowledge, attitudes and practices of health workers and community members in the areas were also examined. The discussion in this section will focus on possible errors, confounding or underlying factors, which may explain the findings of the study.

Prevalence of anaemia

The key indicator of iron deficiency anaemia surveillance is the haemoglobin concentration where prevalence of any anaemia and severe anaemia are the current criteria for assessing the severity and magnitude of iron deficiency anaemia in the population (Stoltzfus, 1997).

For monitoring progress in anaemia control the prevalence of moderate to severe anaemia is said to be more meaningful than the use of prevalence of any anaemia. In this study findings are presented using prevalence of any anaemia because of the small number of subjects. However, use of prevalence of any anaemia will enable us in comparing our data with the previous studies. The use of mean haemoglobin where the number of subjects is low is more appropriate in visualizing the true picture of the problem (Annex 1 a & b).

The prevalence of anaemia in the two population groups in both areas was very high. For under five children no difference was observed in anaemia distribution by age or gender. The only significant association for both under fives and pregnant women were on the occurrence of anaemia by month where May had a higher prevalence than November. The results would probably be different if we had large number of subjects and the observation is made up to the year 2000.

Knowledge on anaemia

Health and nutrition education intervention was instituted to the health workers who are the key actors at the community level. The knowledge acquired by the health workers was supposed to filter to the community to bring out the desirable effects. As observed in this study only 10 percent of the health workers interviewed in the intervention area (IA) did attend the health and nutrition education training.

Although it appears as if training was successful in improving health workers knowledge, this was not reflected into practice. The observed difference in knowledge could be due

to low percentage of those who participated in the training being interviewed in the study. As opposed to the health workers, at the household level the difference between the two areas was significant in most aspects even though the percentage of those who had good knowledge was very low. The difference is unlikely to be due to differences in the effect of health and nutrition education intervention, but could partly be explained by the differences in literacy among the inhabitants. The literacy rate at household level was observed to be high in the IA for both males and females than in the CA.

Practices on anaemia

Nutrition education helps to promote desirable food behavior and nutrition practices (Creed-Kanashiro *et al*, 2000) although the impact of knowledge may be less important than attitudes especially in deciding what to do (Thompson *et al*, 1999). Active participation is more important for changing attitudes which in-turn influence practice. Practices were observed to be better in the CA than in the IA for the health workers. Since most practices are related to their daily activities, the background education might have influenced the findings. The mean number of years spent at school for the health workers in the CA was higher than in the IA.

According to socioeconomic status and geographical characteristics in these settings the CA was better off than the IA. This could have influenced the pattern of food consumed because of the availability of foods and being economically able to purchase.

Attitudes on anaemia

Regarding attitude at community level, the majority of respondents in the IA than in the CA believed that foods, supplements and dark green vegetables were important in preventing anaemia. However, staples were the main foods, which were regularly consumed in these two areas than fruits and legumes. Although a good proportion of households regularly consumed foods of animal origin, sardines and milk were the food items regularly consumed in this food category. Sardines are said to have high amount of iron but milk contains calcium, which is an inhibitor of iron absorption.

Although the majority of respondents believed that taking supplements and eating green vegetables were important in preventing anaemia, the practice of many families subsisting on foods of plant origin and using plenty of milk may have an effect on iron bioavailability.

Moreover, there are many other factors, which can influence the prevalence of anaemia such as diseases and iron bioavailability, the difference in food consumption pattern and the socio-economic status between the two areas can partly explain the findings observed in this study.

In summary it may be stated that the effect of health and nutrition anaemia training for the prevention and control of anemia has not permeated to the community and hence empowering them with the knowledge and better ways of dealing with the problems of anaemia.

OVERALL CONCLUSION AND RECOMMENDATIONS

The health workers and community member's knowledge in respect to causes, effects and control measures for anaemia are still poor. This might have lead to undesirable attitudes and practices thus contributing to the high prevalence of anaemia in under five children and pregnant women. In order to improve the anaemia situation in the population, the following recommendations are made:

Health and nutrition education

- There is a need to re-define the entry point to nutrition training programme and to identify potential change agents. Such entry points could be through the established education system at primary school level and at the teachers training centres. Primary school pupils and primary school teachers could be one example of such potential change agents.

- There is also a need to design appropriate communication strategies, which will draw active participation of policy makers, programme implementers and the community members at large.

- Develop simple information, education and communication (IEC) materials, which will accommodate the 3 micronutrients (i.e. iron, iodine and vitamin A) addressing issues of causes, effects, signs and symptoms and preventive measures. The prevention and control part should highlight issues related to supplementation, fortification, dietary improvement through horticulture and public health measures to control diseases associated with anaemia.

- Activities for the control of anaemia should be part of an integral approach to combat micronutrient malnutrition such as vitamin A deficiency and iodine deficiency disorders. This will enhance maximum utilization of the limited resources.

- There is a need to scale up the already existing programmes to reach a wider coverage. This should go hand in hand with reviewing the present primary school curriculum on health and nutrition education and find opportunities for improving or incorporating issues related to prevention of micronutrient malnutrition.

- Capacity building is essential for programme improvement. Efforts should be directed to those people who are in the vicinity of the community members. Nurses who

constitute the majority of health workers in the rural settings and the primary school teachers should be the prime targets.

- Improvement of health, overall nutrition and education status should be viewed as a pillar to successful reduction of micronutrient malnutrition. Efforts should be put to achieve these goals. Involvement of policy makers is crucial because it involves issues of prioritization and resource allocation.

- Improvement of economy to alleviate poverty and improvement of food security are important strategies for the prevention of micronutrient malnutrition. Special emphasis needs to be given in this area.

Improvement of the anaemia surveillance system

To be able to monitor progress in anaemia control, the use of haemoglobin concentration of selected population groups is important. To achieve this there should be a well-established and functioning surveillance system. The following are recommended regarding anaemia surveillance system:

- There is a need to review the variables included in the data collection tools in order to allow valid analysis of the possible determinants.

- There is a need to extend the coverage not only to those who come to the hospitals but also to those who do not have access to health services. Frequency of data collection should be reviewed as well. A larger interval of data collection than the current of six months apart could be less tiring but should be done simultaneously at all sentinel centres.

- In order to allow large coverage one need to move further to the community. Therefore, possibilities of having more handy, portable and easy to use haemoglobin measuring machines such as HaemoCue for the surveillance sites should probably be a priority. Involvement of the community members in the process will remain a key issue to success.

References:

ACC/SCN. The 3rd Report on the World Nutrition Situation. A report compiled from information available to the ACC/SCN, December 1997: 34-40.

ACC/SCN. Controlling iron deficiency. State of the Art Series No. 9. A report based on an ACC/SCN Workshop, Geneva, 1991.

ACC/SCN. Fourth Report on The World Nutrition Situation. Nutrition Through the Life Cycle. January 2000: 23-27.

Albonico M, Savioli L. Hookworm infection and disease: advances for control. Ann 1st Super Sanita 1997; **33 (4)**: 567-79.

Andrien M. Social Communication in Nutrition: A methodology for Intervention, FAO Publications, 1994.

Anliker JA, Drake LT, Pacholski J, Little W. Impacts of Multi-layered Nutrition Education Program: Teenagers Teaching Children. J Nutr Educ, 1993; **25(3)**: 140-143.

Booth IW, Aukett MA. Iron deficiency anaemia in infancy and early childhood. Archives of Diseases in Childhood. 1997; **76**: 549-554.

Brink MS, Sobal J. Retention of Nutrition Knowledge and Practices among Adult EFNEP Participants. J Nutr Educ 1994; **26(2)**: 74-78.

Bui MD, Humphries D, Le TBM, Ha AD, Trinh MC, Huynh HN, Phan TK. Iron and Vitamin C content of commonly consumed foods in Vietnam. Asian Pacific J Clin Nutr, 1999; **8 (1)**: 36-38.

Cerqueira MT, Olson CM. Nutritional education in the developing countries: an examination of recent successful projects. *In*: Andersen PP, Pelletier D, Alderman H Ed. Child Growth and Nutrition in Developing Countries: Priorities for Action, Ithaca, New York; Cornell University Press 1995: 53-77.

Creed-Kanashiro HM, Uribe TG, Bartolini RM, Fukumoto MN, Lopez TT, Zavaleta MN, Bentley ME. Improving Dietary Intake to prevent Anaemia in Adolescent Girls through Community Kitchens in a Periurban Population of Lima, Peru. J Nutr, 2000; **130**: 459S-461S.

FAOa. Preventing micronutrient malnutrition: A Guide to food- Based Approaches. A manual for policy makers and programme planners: ILSI Press Washington, DC, 1997.

FAOb. Agriculture, food and nutrition for Africa: A resource book for teachers of Agriculture, Food and Nutrition Division, Rome, 1997.

Gill DG, Vincent S, Segal DS. Follow-on formula in the prevention of iron deficiency: a multcentre study. Acta Paediatr 1997; **86**: 683-9.

Gillespie S. Major Issues in the Control of Iron Deficiency. The micronutrient Initiative and UNICEF, 1998.

Hassan K, Sullivan KM, Yip R, Woodruff BA. Factors associated with Anaemia in Refugee Children. J. Nutr. 1997; **127**: 2194-2198.

Howson CP, Kennedy E, and Horwitz A. Prevention of micronutrient deficiencies: a tool for policymakers and public health workers. Institute of Medicine, National Academy Press, Washington DC, 1998.

Izaks GJ, Westendorp RGJ, Knook DL. The Definition of Anaemia In Older Persons. JAMA, May 12, 1999; **281 (18)**: 1714-1717.

Kavishe FP, Mushi SS. Nutrition-Relevant Action in Tanzania. UN ACC/SCN Country Case Study, XV Congress of the International Union of Nutrition Sciences, Sept. 26th to Oct. 1st 1993, Adelaide, Australia.

Magambo FW, Kingamkono RR, Sanga AB. Nutrition, Gender and Poverty: issues and prospects. Proceedings of the 17th Annual Scientific Conference of the Tanzania Public Health Association, Tanga-Tanzania, November 23-26, 1998: 97-104.

Manios Y, Moschandreas J, Hatzis C, Kafatos A. Evaluation of Health and Nutrition Education Program in Primary School Children of Crete over a Three-Year Period. Preventive Medicine, 1999; **28**: 149-159.

Massawe SN, Urassa EN, Nyström L, Lindmark G. Effectiveness of primary level antenatal care in decreasing anaemia at term in Tanzania. Acta Obstet Gynecol Scand, August 1999; **78(7)**: 573-579.

Milman N, Bergholt, T, Byg K *et al*. Iron Status and Iron balance during pregnancy. A critical reappraisal of iron supplementation. Acta Obstet Gynecol Scand, October 1999; **78 (9)**: 749-757.

Mnyika KS. Anaemia in Tanzania. Report to Tanzania Food and Nutrition Centre. TFNC report no. 1436, Dar es Salaam, 1991.

Sorensen G, Morris DM, Hunt MK, Hebert JR, Harris DR, Stoddard A, Ockene JK. Work-Site Nutrition Intervention and Employee's' Dietary Habits: The Treatwell Program. Am J Public Health. June 1992; **82(6)**: 877-880.

Stoltzfus RJ, Dreyfuss ML, Chwaya HM, Albonico M. Hookworm Control as a Strategy to Prevent iron deficiency. Nutr Rev June 1997a; **55 (6)**: 223-32.

Stoltzfus RJ, Albonico M, Chwaya HM, Tielsch JM, Schulze KJ, Saviol L *et al*. Effect of the Zanzibar School based deworming programme on iron status of children; Am J Clin Nutr, 1998 June: **68 (1)**: 179-86.

Stoltzfus RJ. Rethinking anaemia surveillance. Lancet 1997b; **345**: 1764-66.

Szarfarc SC, de Souza SB. Prevalence and risk factors in iron deficiency and anaemia. Arch Latinoan Nutr, June 1997; **47 (2 suppl 1)**: 36-8.

Tanzania Demographic Health Survey (TDHS). Bureau of Statistics, Planning Commission, Dar es Salaam, Tanzania, 1996.

Tanzania Food and Nutrition Centre. Proceeding of the First National Workshop on the Control of Nutritional Anaemia in Tanzania, 1st-5th July, Dar es Salaam, 1991a; TFNC report **no. 1540.**

Tanzania Food and Nutrition Centre. Five Year Programme for the Control of Anaemia in Tanzania. , Dar es Salaam, 1991b; TFNC report **no. 1227.**

Tanzania Food and Nutrition Centre. Nutritional Anaemia Training Module for Extension Workers, Dar es Salaam, 1995; TFNC report **no. 1730.**

Tatala S, Towo E, Urio E. Parasitic infections, anaemia and nutrition situations of children in Mafia district. A report of a nutrition survey. Dar es Salaam, 1996; TFNC report **no. 1751.**

Tatala S, Svanberg U, Mduma B. Low dietary iron availability is a major cause of anaemia: a nutrition survey in the Lindi district of Tanzania. Am J Clin Nutr 1998; **68**: 171-178.

Thompson RL, Margetts BM, Speller VM, McVey D. The Health Education Authority's health and lifestyle survey 1993; who are the low fruit and vegetable consumers. J Epidemiol Community Health, 1999; **53**: 294-299.

Torres MP. Using Commercial advertising agencies in micronutrient promotion: lessons learned. Social Marketing Quarterly, 1995, Summer: **4(4)**: 17-26.

Treiman K, Freimuth V, Damron D, Lasswell A, Anliker J, Havas S, Lanengerg P, Feldman R. Attitudes and Behaviours Related to Fruits and Vegetables among Low-income Women in the WIC Programme. J Nutr Educ, 1996; **28**: 149-156.

Ulmi S, McGowan, P, Gray, D, Savoy, D. Moving beyond information: evaluation of a nutrition education tool based on a theoretical model; Eur Clin Nutr 1999; **53 Suppl 2**: S49 - S53.

United Nations Children's Fund. UNICEF Information Statistics, 1998 (cited 1999 Oct 31). Available from: URL: http://www.unicef.org/statis/country_1Page189.html

UNICEF/UNU/WHO/MI. Preventing Iron Deficiency in Women and Children: Technical Consensus on Key Issues. Technical workshop, October 7-9, 1998. Boston and Ottawa: International Nutrition Foundation and MI, 1999.

UNICEF/WHO. Prevention and Control of Iron Deficiency Anaemia in Women and Children. Report of the UNICEF/WHO Regional Consultation, 3-5 February 1999, Geneva, Switzerland.

United Republic of Tanzania, Ministry of Health; National Health Policy, 1990.

United Republic of Tanzania. Singida Region Socio-economic Profile. Joint Publication by: The Planning Commission Dar es Salaam and Regional Commissioner's Office Singida, 1997a.

United Republic of Tanzania. Dodoma Region Socio-economic Profile. Joint Publication by: The Planning Commission Dar es Salaam and Regional Commissioner's Office Dodoma, 1997b.

Vijayaraghavan K. Strategies for control of micronutrient malnutrition: Indian J Med Res Nov 1995; **102**: 216-22.

Vijayaraghavan K, Brahman GNV, Nair KM, Akbar D, Rao NP. Evaluation of National Nutritional Anaemia Prophylaxis Programme. Indian J Pediatr, 1990; **57**: 183-190.

Viteri, FE. Prevention of Iron Deficiency: *In:* Howson CP, Kennedy E, Horwitz A. Prevention of micronutrient deficiencies: tools for policymakers and public health workers. Institute of Medicine, National Academy Press, Washington DC, 1998; 45-102.

West CE. Iron Deficiency: The problem and approaches to its solutions. Food Nutr. Bull, 1996; **17**: 37-41.

World Health Organization. Poverty and Health in Developing Countries and the potential role of technical cooperation among developing countries (TCDC) for the poverty alleviation and health development. Geneva, 1995 (WHO/ICO/MESD.16).

WHO/UNICEF/UNU. Consultation on Iron Deficiency Indicators and Strategies for Iron Deficiency Control Programme. Geneva: WHO, 1996.

World Health Organization. The Prevalence of Anaemia in Women. A Tabulation of Available Information. Geneva: WHO, 1992 (WHO/MCH/MSM/92.2).

PAPER I

Using anaemia prevalence as a proxy in assessing the effectivity of anaemia training programme among health workers.

Nyagawa, DR[1, 4]., Mnyika, KS[2]., Hussain, A[3].

[1]*Institute of General Practice and Community Medicine*

Department of International Health

University of Oslo

Post Boks 1130, Blindern

0317 Oslo, Norway

[2]*Department of Epidemiology and Biostatistics*

Institute of Public Health

Muhimbili University Collage of Health Sciences

P.O. Box 65015

Dar es Salaam,

Tanzania

[3]*Centre for Clinical Epidemiology*

Rikshospitalet National Hospital

Pilstredet 32, Oslo - 1

University of Oslo

N-0027 Oslo, Norway

[4]*Tanzania Food and Nutrition Centre*

P.O Box 977

Dar es Salaam

Tanzania

Abstract

Objectives: To assess the effectiveness of nutrition education intervention programme among health workers on the status of anaemia in under five children and pregnant women.

Methods: Data on haemoglobin levels were collected from under five children and pregnant women attending maternal and child health clinics for routine check-up through the established anaemia surveillance system. Haemoglobin measurements were done during the months of May and November for the period November 1997 to November 1998. The haemoglobin concentration was determined by the cyanomethaemoglobin method. The anaemia was defined using the WHO cut-off points of Hb < 11g/dl for pregnant women and under five children.

Results: The prevalence of anaemia for the under five children were found to be significantly higher in the intervention area (82%) as compared to the control area (76%, $p = 0.028$). With regards to the age and gender, there was no significant difference between the study areas. Anaemia prevalence among pregnant women was also high in both areas. The control area had a prevalence of 75 percent as compared to the intervention area with the prevalence of 72 percent. When comparing between different gestation ages, both areas showed a decreasing tendency with the increase in gestation age, while no significant difference in prevalence was observed among different parities. In both children and pregnant women, the prevalence was higher in the month of May than in November ($p < 0.001$).

Conclusion: The high prevalence of anaemia observed in children and pregnant women in the intervention area as compared to the control area indicate that improvement of anaemia condition in children and pregnant women through training of health workers is uncertain. However, high prevalence of maternal and child anaemia may call for urgent attention from the concerned authorities.

KEY WORDS: anaemia, iron deficiency anaemia, health and nutrition education, health workers, Tanzania.

Introduction

Anaemia resulting from iron deficiency is one of the major nutritional deficiencies affecting all age groups in the world (WHO/NHD, 2000; WHO, 1999). However, children and women of reproductive age are the most affected groups. The South East Asia and Sub-Saharan Africa remain the most affected regions in the world. According to

the world health report 33 percent of children aged 0 to 4 years and 47 percent of women aged 15 to 59 years are in Africa, and 53 percent of children and 60 percent of women in the same age groups are affected in south East Asia (WHO, 1997).

Iron deficiency anaemia (IDA) is a major public health problem with adverse consequences especially in young children and women of reproductive age. Iron deficiency anaemia in infants and children is associated with impaired physical and cognitive development. In adults, IDA is associated with weakness and fatigue which reduces their work capacity and hence productivity. It contributes to maternal morbidity and mortality resulting in poor pregnancy outcomes (FAO, 1997).

Anaemia in children and women of reproductive age remains a major health problem in Tanzania. Studies conducted between 1993 and 1998 (Ndossi, *et al*, 1998; Tatala, 1998; TFNC, 1998; MORLAG, 1994) indicated that the prevalence of anaemia among under five children vary from 27 percent to as high as 95 percent. For the pregnant women it ranges from 41 percent to 80 percent in some districts. According to hospital-based data, anaemia accounts for a significant amount of morbidity and mortality in the country. It is the leading cause of hospital admissions where it accounts for 20 to 80 percent of the admitted under five children and 18 to over 87 percent of the admitted pregnant women. Anaemia is also a direct cause of 5 percent of maternal mortality and underlying cause in 63 to 73 percent of maternal deaths (Mnyika, 1991).

Anaemia prevalence tends to vary according to the country's geographical pattern. The coastal belt and other lowland areas have high prevalence of anaemia (Tatala, 1998; Massawe *et al*, 1996) and decreasing towards inland to high altitude areas (Hinderaker *et al*, 2001). Diseases like malaria and worm infestations, and dietary factors may also influence the differences in the prevalence in different areas of the country.

The high prevalence of anaemia in the country necessitated the introduction of an intervention programme aimed to control anaemia in 1982. As outlined in the five-year plan (1991-95), one of the objectives of the National Programme for the Control and

Prevention of Anaemia (NACP) was to create awareness and increase knowledge of the problem of anaemia and ways of its control at all levels (TFNC, 1991).

The strategies adopted by NACP to address the issues of anaemia in the community, was to raise awareness and increase the knowledge of the causes and consequences of anaemia and control measures through anaemia training workshops for the health workers.

Following health and nutrition education programme among the health workers, there was a need to monitor the trend of anaemia prevalence in the community. A national anaemia surveillance system was therefore developed in 1997 (TFNC, 1998). Twenty-five sentinel district hospitals were identified from 20 regions of the mainland Tanzania. The system was aimed at continuously generating data and provide necessary feedback to the programme for decision making.

This study was designed to assess the effectiveness of health and nutrition education programme for the health workers in relation to the prevalence of anaemia in the community.

Materials and methods

Areas

Twenty-five district hospitals were chosen to represent at least each of the 20 regions of the mainland Tanzania. Training of laboratory technicians followed the selection of the sentinel district hospitals from the sentinel district laboratory on anaemia surveillance system.

Each of the sentinel hospital laboratories was supplied with a haemoglobin-measuring machine (Jenway colorimeter, Model 6030,UK). The haemoglobin measurements were scheduled to be carried out twice a year, in May and November representing the rainy and dry seasons, respectively. The first data collection started in November 1997.

Subjects:

All children below five years of age and pregnant women attending maternal and child health clinics (MCH) for routine check up in the two chosen months were recruited for haemoglobin measurements. A data collection instrument was designed for children and pregnant women and it included district, region, month, year, and haemoglobin levels. For pregnant women extra information on parity and gestation age was also collected while for children information on sex and age was recorded.

Laboratory methods:

Anaemia was defined as haemoglobin (Hb) below 11 gm/dl according to WHO cut-off points for children below five years and pregnant women (WHO/UNICEF/UNU, 1996). The haemoglobin concentration in the sentinel laboratory was determined by the cyanomethaemoglobin method. Using disposable lancets, a finger-prick is performed and 0.02 mls of blood is collected and added to 5 mls Drabkins Solution. The samples are mixed and absorbance read after 10 min at 540 nm. The results are recorded as Hgb in gm/dl. Haemoglobin measurements and collection of data take place every working day from the first to the last day of the two months.

Ethical issues

Verbal consent from pregnant women and nursing mothers who attended the MCH clinics was obtained for haemoglobin measurements. For safety precautions disposable lancets and gloves were used.

Statistical analysis

Data analysis was performed using Statistical Package for Social Sciences (SPSS) version 9.0. A Chi-square test was used to analyse categorical variables for the difference, while student *t* test was used for continuous variables. All *p*-values presented are two-tailed and were considered statistically significant if *p* was less than 0.05.

Results

Haemoglobin levels were measured from 930 under five children of whom, 618 and 317 were from the intervention and the control area, respectively. Of the 618 children from the intervention area, 241 were from 1997 and 377 from 1998. For the control area there were 110 children in 1997 and 207 in 1998. For both areas, children aged less than 2 years (0-23 months) constituted more than 50 percent of the study population (table 1). Their mean age was 18.9 ± 14.6 months for the intervention area and 22.2 ± 14.9 months for the control area (p = 0.001). With regard to gender, in the intervention area males and females were almost in equal proportions while in the control area there were more females (55%) than males (45%).

Overall, 82 percent of children in the intervention area were found to be anaemic as compared to 76 percent in the control area with a significant difference at p-value of 0.025 (table 1). The 1998 prevalence of anaemia was high in both areas than 1997 with the intervention area having the highest prevalence by 11 percent (p = 0.001). Looking at the total prevalence by month, May had significantly high prevalence as compared to November in both intervention and control areas with p-values of 0.003 and 0.000, respectively.

Comparing the prevalence of anaemia by year, there was an increased prevalence in 1998 for both intervention and the control areas. The increase was found to be significantly higher in the intervention area ($p < 0.001$) than the control area ($p = 0.167$).

With respect to age there was no significant difference in the prevalence between the intervention and the control areas with the exception of age group 0 to 11 months. The prevalence in this age group was 15 percent higher in the intervention area than in the control area ($p = 0.002$).

Table 1: Prevalence of anaemia among children below five years by area, age and; year and month in rural Tanzania

	Intervention area (IA)			**Control area (CA)**			
	n	anaemic	prevalence %	n	anaemic	prevalence %	p-value
Age:							
0-11	234	196	84	96	66	69	.002
12-23	174	150	86	70	57	81	.347
24-35	111	84	76	75	59	79	.635
36-47	47	39	83	35	28	80	.730
48-59	52	40	77	36	27	75	.835
Year/month:							
1997							
Nov	241	175	73	110	79	72	.877
1998							

May	267	234	88	101	101	99	.001
Nov	110	100	91	106	63	59	.000
Total	***377***	***334***	***89***	***207***	***163***	***79***	***.001***
Months total							
May	267	234	88	101	100	99	.001
Nov	351	275	78	216	142	66	.001
p-value			0.003			0.000	
Year total							
1997	241	175	73	110	79	72	.877
1998	377	334	89	207	163	79	.001
p-value			0.000			0.167	
Total	**618**	**509**	**82**	**317**	**242**	**76**	**.028**

With regard to gender-age specific for the under five children (table 2), generally the prevalence of anaemia was high in both sexes. In the intervention area however, the prevalence was slightly higher than in the control area. The only significant difference is in the age group 0 to 11 months in the males (p = 0.007) and 12 to 23 months in the females (p = 0.018).

Table 2: Prevalence of anaemia for the children in the IA and CA by age and sex

		IA			CA		
Age	n	anaemic	prevalence **%**	n	anaemic	prevalence **%**	p-value
Males							
0-11	119	100	84	49	32	65	.007
12-23	80	64	80	27	24	89	.390
24-35	50	41	82	35	26	74	.392
36-47	27	21	78	14	10	71	.712
48-59	26	22	85	16	12	75	.454
Total	*302*	*248*	*82*	*144*	*107*	*74*	*.056*
Females							
0-11	115	96	83	47	34	72	.106
12-23	94	86	91	43	33	77	.018
24-35	61	43	70	40	33	82	.171
36-47	20	18	90	21	18	86	.675
48-59	26	18	69	20	15	75	.667
Total	*316*	*261*	*83*	*173*	*135*	*78*	*.219*

Total	**618**	**509**	**82**	**317**	**242**	**76**
	.028					

A total of 515 pregnant women were recruited for haemoglobin measurements. One hundred and twenty seven were from the intervention area, 78 of them being those recruited in 1997 and 49 in 1998. The control area recruited 196 in 1997 and 192 in 1998.

The overall prevalence of anaemia for pregnant women in both intervention and control areas was over 70 percent (table 3). There was an increased prevalence in both areas in 1998 as compared to 1997. For the intervention area the increase was by 12 percent while in the control area the increase was by 5 percent. The overall prevalence by months, May had the highest in both areas as compared to November in favor of the intervention area ($p < 0.001$). The total prevalence for pregnant women was high in the control area although the difference observed between the two areas was not statistically significant.

The overall findings on the prevalence of anaemia with regards to parity, there was a difference in the prevalence by 16 percent in the intervention area while in the control area the difference was only 2 percent. However, the difference observed between the two areas was not statistically significant.

Regarding prevalence of anaemia in pregnant women with respect to parity between 1997 and 1998, findings indicate that there was an increase in the prevalence in both intervention and control areas in the year 1998. The increase was mainly observed for those women who had 4 or more deliveries in which the intervention area had an increase of 24 percent as compared to the control area with an increase of 19 percent.

Comparing the prevalence of anaemia with respect to the gestation age, there was a low prevalence in both areas for those pregnant women who were 25 weeks of gestation or more. The overall decrease was more in the intervention area (18%) as compared to the control area (8%). When the prevalence of anaemia is looked according to the years, it is observed that in 1998 there was an increase in the prevalence for both areas in gestation ages and parity.

For the gestation age, the increase in prevalence was more in the intervention area for both those who were 1-24 weeks of gestation (19%) and 25 weeks and more (12%). With regard to parity both areas had increased prevalence for those pregnant women who had four or more deliveries, 24 percent in the IA and 19 percent in the CA.

Table 3: Prevalence of anaemia for pregnant women in the study areas by year, month, parity and gestation age

	IA			CA			
			%			%	
Year:							
	n	anaemic	prevalence	n	anaemic	prevalence	p-value
1997							
Nov	*78*	*53*	*68*	*196*	*142*	*72*	*.458*
1998							
May	36	28	78	89	88	99	.000
Nov	13	11	85	103	60	58	.066
Total	**49**	**39**	**80**	**192**	**148**	**77**	**.707**
Months total							
May	36	28	78	89	88	99	.000
Nov	91	64	70	299	202	68	.619
P-value			.397			.000	
Parity:							
1997							
0-3	61	40	66	153	115	75	.156
4+	17	13	76	43	27	63	.311

1998							
0-3	40	30	75	124	94	76	.918
4+	9	9	100	68	54	82	.198
Parity total							
0-3	101	70	69	277	209	75	.229
4+	26	22	85	111	81	73	.216
P-value			0.119			0.612	
G/age(wk):							
1997							
1-24	16	13	81	100	77	78	1.000
25+	62	40	64	96	65	68	.678
1998							
1-24	7	7	100	71	58	82	.594
25+	42	32	76	121	90	74	.816
Total G/age (wk)							
1-24	23	20	87	171	135	79	.579
25+	104	72	69	217	155	71	.686
P-value			0.085			0.091	
Total	**127**	**92**	**72**	**388**	**290**	**75**	**.607**

Discussion

The present study analysed data on haemoglobin levels reported from the two surveillance sites (intervention and control area). The haemoglobin levels collected by the surveillance system were aimed at monitoring the progress of anaemia prevalence following health and nutrition education programme among the health workers on anaemia. The assumption behind this thinking was that if health workers did carryout the intervention strategies to the community after the training i.e. supplementation, health education on dietary diversification and public health measures, the impact of the intervention should be reflected by the change of anaemia prevalence in the community.

The high prevalence of anaemia in this study indicates that anaemia is still of public health significant since the prevalence of anaemia in both pregnant women and under five children is more than 40 percent (WHO/UNICEF/UNU, 1996). According to the ACC/SCN (1997), when the prevalence of anaemia in a population for both groups is

more than 50 percent, the cause of anaemia is most likely to be due to iron deficiency. There is no doubt that even in this study population the high prevalence of anaemia of more than 70 percent signifies that the cause of anaemia is iron deficiency.

The reasons why under five children and pregnant women are the most vulnerable, the magnitude of the problem of iron deficiency and iron deficiency anaemia and the consequences in these groups have been explained elsewhere (ACC/SCN, 2000; Milman *et al*, 1999; WHO, 1999; Howson *et al*, 1998).

In this study population it has been observed that regardless of gender or age for the children below five years of age, both seem to be equally affected (table 1). One would have expected to find a decrease in the prevalence of anaemia in the year 1998 and especially in the intervention area. However, this wasn't the case and the increase was even more than in the control area. It is difficult to associate a single cause of these finding, as there are many factors, which might have played a role. However, weather changes observed towards the end of 1997 and 1st half of 1998 brought by the El Niño scuffle could be just one explanation of such observation.
The El Niño cycle is said to be associated with increased risks of some of the diseases transmitted by mosquitoes, such as malaria, dengue and Rift Valley fever (WHO, 2000). Therefore, this may have lead to the increased prevalence of malaria in areas affected by El Niño. Heavy rainfalls also caused floods destroying crops and infrastructure leading to food shortage to many families. Other factors like knowledge, attitude and practices of health workers and community members, which could highlight the contribution to the high prevalence, have been explained elsewhere (Nyagawa *et al*, 2001, unpublished).

In pregnant women anaemia prevalence was 72 percent in the intervention area and 75 percent in the control area. The difference although not significant was in favour of the intervention area. Despite of the minor difference observed in the two areas, the prevalence was relatively high.

Prevalence of anaemia has been found to be associated with seasonal patterns (Meda *et al*, 1999). During rainy season prevalence of infections like malaria, hookworm infestations and schistosomiasis are high. The month of May represents the late part of the rainy season in most parts of the country, including the two study areas. Therefore, our findings may partly have been influenced by seasonal variations. There was significant difference in the prevalence for the two months in the control area for both under five children ($p < 0.001$) and pregnant women ($p < 0.001$) and only for the under five children in the intervention area ($p = 0.003$).

In pregnant women although iron deficiency plays a significant role in anaemia causation, malaria is also a common cause especially in the developing countries where prevalence of malaria is high (Menendez, 1995). Although the data is limited for further analysis of the associated factors, however the extent of the problem in pregnant women deserves further attention.

In a study by Dreyfuss *et al* (2000) in Nepalese women demonstrated that nulliparous women had a lower prevalence of anaemia although the prevalence of moderate to severe anaemia did not differ by parity. In this study the highest prevalence was observed to those who had 4 or more children. High parity is said to be associated with increased prevalence of anaemia especially where the spacing between pregnancies is short (Mahfouz *et al*, 1994). This is mainly due to the failure to replenish the iron store depleted during previous pregnancies resulting from frequent childbirth with short intervals.

Dreyfuss *et al* (2000) and Massawe *et al* (1999) as demonstrated in their study results, women who booked late in pregnancy had low haemoglobin levels than those who booked earlier. In this study we observed a different trend where those with low gestation age were more anaemic. Haemoglobin measurements in this study were taken from pregnant women attending MCH clinic regardless whether they were attending for the first time or re-attendance. Since many of the pregnant women were in their third trimester, we can speculate that probably they had attended the antenatal clinic (ANC)

before and thus being supplied with iron and folate tables, which might have affected their haemoglobin levels.

The high prevalence of anaemia in the two groups could be due to many other reasons. One may suggest that there is very little or no interventions being carried out in these areas, or interventions to prevent and control anaemia are carried out in isolation. The health workers were invested with the knowledge for carrying out all possible interventions necessary for the control of anaemia. However, in order to have a significant change in the prevalence, one need to apply a multi-mix of interventions (UNICEF/UNU/WHO/MI, 1999; Gillespie, 1998) since there is no single intervention, which is likely to have any significant effect in improving the anaemic condition.

Although the aim of this study was to assess the effect of health education intervention programme instituted to the health workers, this study also shades light on the performance of the national anaemia surveillance system. There was irregular data collection and reporting on haemoglobin levels from the sentinel sites. The anaemia surveillance system, which started in November 1997 by May 2000, all surveillance sites were supposed to have collected and reported data on hb measurements six times.
In this study the intervention area reported data only 3 times for both children and pregnant women while the control area reported 5 times for the children and 6 times for the pregnant women. Furthermore, there was a greater variation on the number of subjects recruited for hb measurements, which kept on decreasing with time. This trend may reflect lack of motivation of health workers or lack of supervision and thus deceiving the purpose of the surveillance system to which it was developed to serve.

Conclusion

The role of health workers in the prevention and control of anaemia in the community and especially to the pregnant women and under five children is crucial. Since the prevalence of anaemia in both areas is significantly high and the difference between the intervention and the control areas is not significant, the effect of the health and nutrition education given to health workers in the intervention area remain a matter of uncertainty.

A more diverse strategy of implementing health and nutrition education intervention programme is needed not only being directed to health workers but also involving concerned community members.

References:

ACC/SCN. The 3rd Report on the World Nutrition Situation. A report compiled from information available to the ACC/SCN, December 1997: 34-40.

ACC/SCN. Fourth Report on The World Nutrition Situation. Nutrition Through the Life Cycle. January 2000: 23-27.

Dreyfuss ML, Stoltzfus RJ, Shrestha JB, Pradhan EK, LeClerq SC, Khatry SK, Shrestha SR, Katz J, Albonico M, West KP Jr. Hookworm, malaria and Vitamin A Deficiency Contribute to Anaemia and Iron Deficiency among Pregnant Women in the Plains of Nepal. J. Nutr. 2000; **130**: 2527-2536.

FAO. Agriculture, food and nutrition for Africa: A resource book for teachers of Agriculture, Food and Nutrition Division, Rome, 1997.

Gillespie S. Major Issues in the Control of Iron Deficiency. The micronutrient Initiative and UNICEF, 1998.

Hinderaker SG, Olsen BE, Bergsjo P, Lie RT, Gasheka P, Kvåle G. Anaemia in pregnancy in the highlands of Tanzania. Acta Obstet Gynecol Scand, 2001; **80**: 18-26.

Howson CP, Kennedy E, and Horwitz A. Prevention of micronutrient deficiencies: tools for policymakers and public health workers. Institute of Medicine, National Academy Press, Washington DC, 1998.

Kavishe FP, Mushi SS. Nutrition-Relevant Action in Tanzania. UN ACC/SCN Country Case Study, XV Congress of the International Union of Nutrition Sciences, Sept. 26th to Oct. 1st 1993, Adelaide, Australia.

Mahfouz AA, El-Said MM, Alakija W, Badauri IA, Al-Erian RA, Moneim MA. Anaemia among pregnant women in the Asir region, Saudi Arabia: an epidemiologic study. Southeast Asian J Trop Med Public Health, Mar 1994; **25 (1)**: 84-87.

Massawe S, Urassa E, Lindmark G, Moller B, Nyström L. Anaemia in pregnancy: a major health problem with implications for maternal health care. Afr J health Sciences, 1996; **3**: 126-32.

Massawe SN, Urassa EN, Nyström L, Lindmark G. Effectiveness of primary level antenatal care in decreasing anaemia at term in Tanzania. Acta Obstet Gynecol Scand, August 1999; **78(7)**: 573-579.

Meda N, Mandelbort L, Cartoux M, Dao B, Ouangre A, Dabis F. Anaemia during pregnancy in Burkina Faso, West Africa, 1995-96: prevalence and associated factors. Bulletin of World Health Organization, 1999; **77 (11)**: 916-922.

Menendez C. The impact of malaria on Iron Status. Proceedings of the meeting: Intervention for Child Survival, London, United Kingdom, May 17-18, 1995.

Milman N, Bergholt, T, Byg K *et al*. Iron Status and Iron balance during pregnancy. A critical reappraisal of iron supplementation. Acta Obstet Gynecol Scand, October 1999; **78 (9)**: 749-757.

Mnyika KS. Anaemia in Tanzania. A situation analysis. A consultancy report to Tanzania Food and Nutrition Centre, 1991, Dar es Salaam, Tanzania. TFNC report **no. 1436**.

MORALG (Ministry of Regional Administration and Local Governments). Tanzania Health and Nutrition Survey, Component II-1994, Baseline Survey Report, 1994, Dar es Salaam, Tanzania. TFNC report **no. 1669**.

Ndossi GD, Kimboka S, Gebreselassie H. Development and field test of a protocol for a rapid assessment of anaemia. S A J Clin Nutr, February 1998; **89(2)**: **Micronutrient Supplement**; 26-29.

Nyagawa DR, Mnyika KS, Hussain A. Health workers and community members' knowledge, attitudes and practices on anaemia in Tanzania, 2001(unpublished).

Tanzania Food and Nutrition Centre. Five Year Programme for the Control of Anaemia in Tanzania, 1991, Dar es Salaam, Tanzania. TFNC report **no. 1227**.

Tanzania Food and Nutrition Centre. The National Anaemia Surveillance System, 1998, Dar es Salaam, Tanzania. TFNC report **no. 1925**.

Tatala S, Svanberg U, Mduma B. Low dietary iron availability is a major cause of anaemia: a nutrition survey in the Lindi district of Tanzania. Am J Clin Nutr 1998; **68**: 171-178.

UNICEF/UNU/WHO/MI. Preventing Iron Deficiency in Women and Children: Technical Consensus on Key Issues. Technical workshop, October 7-9, 1998. Boston and Ottawa: International Nutrition Foundation and MI, 1999.

World Health Organization. Turning the tide of malnutrition: responding to the challenge of the 21st century, 2000, WHO/NHD/00.7.

World Health Organization. Reduction of maternal mortality. A Joint WHO/UNFPA/UNICEF/World Bank Statement, 1999.

World Health Organisation. El Niño and its health impacts. WHO Information Fact Sheets, March 2000 (cited 2001 April 8); Fact Sheet No. 192. Available from: URL: http://www.who.int/inf-fs/en/fact192.html

PAPER II

Health workers and community members' knowledge, attitudes and practices on anaemia as a consequence of training among health workers in Tanzania.

Nyagawa, DR[1,4]., Mnyika, KS[2]., Hussain, A[3].

[1]*Institute of General Practice and Community Medicine*

Department of International Health

University of Oslo

Post Boks 1130, Blindern

0317 Oslo, Norway

[2]*Department of Epidemiology and Biostatistics*

Institute of Public Health

Muhimbili University Collage of Health Sciences

P.O. Box 65015

Dar es Salaam,

Tanzania

[3]*Centre for Clinical Epidemiology*

Rikshospitalet National Hospital

Pilstredet 32, Oslo - 1

University of Oslo

N-0027 Oslo, Norway

[4]*Tanzania Food and Nutrition Centre*

P.O Box 977

Dar es Salaam

Tanzania

Abstract

Objective: The objective was to assess the knowledge, attitudes and practices of health workers and community members following health and nutrition education intervention programme on anaemia.

Methods: A cross-sectional study was conducted involving 97 health workers and 319 community members in the intervention area, and 104 health workers and 322 community members in the control area in October 2000. Respondents were interviewed using a semi-structured questionnaire to elicit socio-demographic data and information on knowledge, attitudes and dietary practices on anaemia. The study areas were among the sentinel sites for anaemia surveillance. The intervention area was randomly selected among those sentinel sites where health workers had undergone training on nutritional anaemia. The control area was selected from the sentinel sites but the health workers were not trained.

Results: The results of the survey indicate that there was an improved knowledge on anaemia for the health workers and community members in the intervention area as compared to the control area (p=0.000). However, the improved practices did not reflect the effect of improved knowledge in the intervention area as compared to the control area. With regards to food consumption pattern at household level, the control area had significantly higher regular consumers in all 5-food groups. However, the foods regularly consumed were mainly staples, 88 percent in the intervention area and 98 percent in the control area. Foods of animal origin were regularly consumed by 33 and 53 percent of households in the intervention and control areas, respectively.

Conclusion: The results of this study suggest a need for reviewing the health and nutrition education intervention programme in the country. Focus should be directed at identifying potential change agents and designing communication strategies that will draw active participation of the community members in addition to the health workers.
KEY WORDS: anaemia, iron deficiency anaemia, knowledge, attitude and practice, health workers, Tanzania.

Introduction

Iron deficiency anaemia (IDA) is an important public health problem for children and women of childbearing age as it is the most common nutritional disorder in the world. According to the current review on the magnitude of the problem (Stoltzfus, 2001; UNICEF/UNU/WHO/MI, 1999), iron deficiency and its anaemia is estimated to affect nearly 3.5 billion people, which is about 60 to 80 percent of the worlds population.

The main cause of nutritional anaemia is iron deficiency largely resulting from inadequate dietary intake of foods rich in iron and folate. Malaria and worm infestations are among other causes of iron deficiency and anaemia. Insufficient dietary intake is also related to poor dietary content of absorbable iron, which is mostly observed in the developing countries (Gillespie, 1998; ACC/SCN, 1997).

Both iron deficiency and anaemia have profound negative effect on human health and development. It is associated with increased maternal and new-born mortality, impaired development of infants and children, limited learning capacity, impaired immune function and reduced working and productive capacity in adults (Howson *et al*, 1998; FAO, 1997).

In Tanzania, anaemia is highly prevalent affecting about 32 percent of the total population. Women of reproductive age and children are the most commonly affected where up to 45 percent of under five children and 80 percent of pregnant women are anaemic (Kavishe, 1993). The identified causes are basically due to low iron intake and poor bioavailability of dietary iron (Tatala, 1998; Kavishe, 1993); and diseases, which are mainly malaria, worm infestations and schistosomiasis (Beasley *et al*, 2000; PCD, 1998).

The National Anaemia Control Programme (NACP) is the implementing agency for project activities related to anaemia prevention and control. Among the strategies used by the NACP for prevention and control of anaemia in the country is to create awareness and increase the knowledge for the control at all levels, and promote adequate and regular intake of foods rich in micronutrients essential for blood formation.
Health workers have been the focal point for delivering health services including implementation of the NACP activities to the community. To equip health workers with necessary information about the problem of anaemia, nutritional training on anaemia was initiated in 1995. The training focused on the nature of the problem, manifestations and effects of anaemia. It also covered aspects of prevention including control of malaria, worm infestations like hookworms and schistosomiasis. The promotion of production and use of foods rich in iron, folate and vitamin C through horticulture, and small animal husbandry was also covered (TFNC, 1995).

For successful implementation of the health and nutrition education intervention, it is imperative for the programme implementers to know the outcome of the nutrition anaemia training programme among health workers and the community. Therefore we

conducted the study to assess the outcome including prevention of anaemia, and also knowledge, attitudes and practices for both health workers and community members.

Materials and methods

Study design and study areas

A cross-section study was conducted in the rural areas of Iramba and Kondoa districts in October 2000. The two districts are located in the central part of the mainland Tanzania belonging to two bordering regions, Singida for Iramba and Dodoma for Kondoa. The respondents were interviewed only once to collect information regarding the occurrence of anaemia in relation to knowledge, attitude and practice.

Selection of the study areas

The study areas were selected among the 25 sentinel districts for anaemia surveillance in the mainland Tanzania. Iramba district that represents the intervention area (IA) was randomly selected among the 13 districts in which health workers had undergone training on nutritional anaemia. The inclusion criteria to which only Iramba satisfied for the intervention area were having at least 3 haemoglobin observations and an initial prevalence of anaemia of 60 percent or more for both pregnant women and under five children.

A corresponding control area (CA), which is Kondoa district, was selected for comparability in the socio-economic and demographic characteristics among 12 sentinel district for anaemia surveillance in which health workers were not trained on nutritional anaemia.

Study population

Health workers from the rural health facilities and the heads of the households from the selected villages constituted the study population. The health facilities were selected representing the wards in the district. Each ward was represented by at least one health facility. For the IA there were 28 health facilities visited while 35 health facilities were visited in the CA.

In each health facility, the target was to interview 4 health workers who provide basic services in the rural health facilities. Since the number of health workers in most of the health facilities was not more than 4, all health workers found at the time of the interview were interviewed. Accordingly, 97 and 104 health workers were interviewed in the IA and CA, respectively.

The categories of health workers interviewed included: a) nurses without basic nursing training (nurse attendant and nurse auxiliary), b) nurses with basic nursing training (nurse midwives and maternal and child health aides); c) clinicians without a medical degree (assistant clinical officers, clinical officers and assistant medical officers).

The villages visited were those that were served by the selected health facilities. Wards that happened to have more than one health facility, only one village was taken for the inclusion in the study. Within a village, selection of the households was based on the grouping of the ten cell leaders in each hamlet. A list of households with at least a child below five years was made with the help of village leaders.

A random selection was then performed to have about 7 households in each hamlet, making a total of 13 households in each village. A total of 33 households in the IA and 30 in the CA were not visited due to absenteeism and refusal to participate. Therefore, 23 villages with a total of 319 households and 25 villages with a total of 322 households were visited in the IA and CA, respectively.

In each household, a father, a mother or caretaker was interviewed on knowledge, attitude and practices regarding the problem of anaemia and its prevention and control measures.

Sample size

The sample size calculation was based on the initial prevalence of anaemia from the first data collected by the anaemia surveillance system, which was 70 percent. Significance level was set at 0.05 and a power of 80 percent to detect a reduction of anaemia by 15 percent. The calculated sample size was 320. The sample size was then increased by 10

percent to take care of dropouts and refusal to participate; the sample size was then 352 from each district. The response rate was about 91 percent for both the IA and CA.

Data collection

Direct personal interviews were conducted using two sets of open-ended questionnaires. One set of questionnaire was for the health workers and another for the community members (households). Questions were formulated to address issues related to knowledge, attitudes and practices in the prevention of anaemia.

The questionnaire for the health workers mainly addressed background characteristics, knowledge on the causes, effects, preventive and control measures of anaemia. Other issues addressed included practices related to the prevention and control of anaemia. The household questionnaire also included background characteristics, knowledge on the causes, symptoms, effects, and prevention and control measures for anaemia. Attitudes about anaemia and practices related to prevention and control were also addressed. Food consumption pattern, sanitation and home yard gardening and animal husbandry were among the practices included in the household questionnaire.

Data analysis

Statistical Package for Social Sciences (SPSS) for WINDOWS version 9.0 was used for data analysis. A χ^2- and student t-tests were used for association between categorical and continuous variables, respectively. Significance level was accepted as $p < 0.05$. All p-values presented are two-tailed.

The questions on knowledge and practice had several options (annex 4), which were given equal weight. The assessment on knowledge and practice for health workers and household members was based on a 3-point scale, which later were categorised as having good, moderate and low knowledge and practice, respectively. Therefore, those who answered more than 2/3 of the options scored good, 1/3 to 2/3 of the options scored moderate while those who answered less than 1/3 of the options scored low.

In addition, dietary assessment based on 7 days recall was instituted to the community members. Initial analysis was based on a 5-point scale with respect to single food items in each food group. These were later classified into 3 categories: regular consumer, occasional consumer and never consumed. The categories were based on 5 food groups.

The first group of staples included, rice, maize pulp and millet or sorghum pulp. Amaranth, cassava leaves, cowpea leaves, pumpkin leaves and sweat potato leaves were food items in the second group of dark green leafy vegetables. Leguminous foods were the third group and it consisted of beans, small beans, small peas and pigeon peas. The fourth group was that of fruits. Fruits under this group were oranges, papaw, baobab, tamarind and guava. The last group was of foods form animals sources, which were liver, kidneys, milk, chicken, fish/sardines and meat from cow, goats or sheep.

Regular consumers were those who consumed one or more of the food items in a particular food group once or more in a day. Occasional consumers were those who consumed once to 6 times in a week of any of the food items in the food category. The 3rd category included those who never consumed any of the food items.

Ethical considerations

Clearance to conduct the study was obtained from Tanzania Food and Nutrition Centre (TFNC) and The Norwegian Research and Ethics Committees. Informed verbal consent was sought from the representatives of the communities and the households selected for the study. Explanation was given to the incharge of the health facility and the respondents from the household on the purpose of the study prior to the interview. Individuals who decided not to participate in the study were respected of their decision.

Results:

Health workers

The study population consisted of 97 health workers from the IA and 104 from the CA. The intervention area constituted 69 percent of the females and 31 percent of the males

while in the CA, 59 percent were females and 41 percent males. There was no significant difference between respondent's age distribution and mean in the two areas (table 1). There were significant differences on years of schooling males having spent more years than females in both areas with p-values of 0.023 in the IA and 0.000 in the CA.

Regarding qualification, the nurse attendants and nurse auxiliaries constituted the majority in both areas. The group with the least cadre of health workers was the MCH aids and nurse midwives. With regards to the working experience, those who worked for more than 15 years in the IA were the majority, while in the CA they were in equal proportions. Surprisingly only 10 percent of those interviewed in the IA attended the anaemia training workshop.

Table 1: Description of the health workers involved in the study

	IA* (n=97) **%**	**CA†** (n=104) **%**	p-value
Age, yr (%)			0.677
< 36	30	35	
36-42	38	38	
≥ 43	32	27	
mean age ± SD	39.1 ± 6.2	38.7 ± 7.1	
Gender (%)			0.125
male	31	41	
mean age ± SD	41.5 ± 6.7	41.6 ± 6.1	
female	69	59	
mean age ± SD	37.9 ± 5.7	36.6 ± 7.1	
Education, yr (%)			0.292
up to 8	32	39	
9-12	46	36	

≥ 13	22	25	
mean yr ± SD			
males	11.2 ± 2.9	12.5 ± 2.5	
females	9.9 ± 2.3	8.9 ± 1.5	
p-value	*0.023*	*0.000*	
Qualification (%)			0.065
natt, naux[1]	51	47	
mch, nw[2]	24	14	
aco, co[3]	25	39	
Working experience, yr			0.421
< 16	44	50	
≥ 16	56	50	
mean yr ± SD	16.6 ± 6.9	15.5 ± 7.5	
Did attend nutritional anaemia training	10	0	0.001

* - Intervention Area (Iramba district)
† - Control Area (Kondoa district)
[1]- nurse attendant, nurse auxiliary
[2]- maternal and child health aides, nurse midwifes
[3]- clinicians without a medical degree –clinical officers and assistant clinical officers

Households' members

At the community level 319 respondents from the IA and 322 from the CA were interviewed. Females dominated in about 80 percent in both areas (table 2). The mean age of the respondents in the IA was 32.4 ± 10.0 and 33.1 ± 10.2 in the CA. About 86 percent of the respondents in the IA were subsistence farmers while the CA had 92 percent of the farmers. The literacy rate was high over 70 percent in both areas though low to the national level of 87 percent for males and 82 percent for females. The majority

Table 2: Description of the study sample at household's level

Demographic variables	**IA** (n=319)	**CA** (n=322)	p-value
Age of respondents, yr (%)			.691
< 30	30	27	
30-39	48	50	
≥ 40	22	23	
mean	32.4 ± 10.0	33.1 ± 10.2	.440
Gender of respondents (%)			
male	18	20	.455
mean age ± SD	40.2 ± 11.3	38.5 ± 11.4	

female	82	80	
mean age ± SD	30.7 ± 8.8	31.7 ± 9.5	
Occupation of respondents (%)			
subsistence farmers	86	92	.022
others‡	14	8	
Education of respondents, yr (%)			
illiterate	23	27	.265
literate	77	73	
mean (s.d.) (Total, yr)	6.2 ± 2.7	5.6 ± 2.9	.002
males	6.9 ± 2.2	6.1 ± 2.6	
females	6.1 ± 2.8	5.4 ± 2.9	
Marital status of respondents (%)			
single	12	7	.030
married	84	85	
other§	4	8	
Households' family size (%)			
up to 5 members	48	48	.252
≥ 6 members	52	52	
mean family size	5.9 ± 2.4	6.1 ± 2.5	.587
Socioeconomic (%)			
high	8	14	.004
middle	26	32	
low	66	54	

‡ - petty businessmen, civil servants, students, unemployed and housewives
§ - widow, divorced and cohabiting

of the respondents were married with a family size of about 6 members in both areas. The socio-economic status was found to be high in the CA than in the IA ($p = 0.004$).

Knowledge on anaemia

Health workers

A significant difference was observed in the knowledge between the IA and the CA in relation to the effects of anaemia, risk groups for anaemia, reasons as to why pregnant women are more susceptible to anaemia and on the preventive measures for anaemia. However, the percentage of those with good knowledge in various aspects was low below 17 percent in both areas. The only area where health workers were more knowledgeable was on the prevention of malaria and hookworm infection (table 3).

Table 3: Health workers knowledge on anaemia

	IA (n=97) **%**	**CA** (n=104) **%**	**P-value**
Cause of anaemia			.090
good	15.5	9.6	
moderate	72.2	84.6	
poor	12.4	5.8	
Effects of anaemia			.015
good	15.5	7.7	
moderate	64.9	55.8	
poor	19.6	36.5	
Risk groups for anaemia			.001
good	7.8	0.0	
moderate	21.1	40.2	
poor	71.1	59.8	
Reason why pregnant women become anaemic			.005
good	1.0	0.0	
moderate	78.4	59.6	
poor	20.6	40.4	
Prevention and control measures for anaemia			.042

good	10.3	1.9	
moderate	46.4	49.0	
poor	43.3	49.0	
Foods rich in iron and folic acid			.263
good	3.1	0.0	
moderate	94.8	98.1	
poor	2.1	1.9	
Role of vitamin C in prevention of anaemia			.092
good	16.5	8.7	
poor	83.5	91.3	
Role of breast feeding in prevention of anaemia			.214
good	0.0	1.0	
moderate	60.8	50.0	
poor	39.2	49.0	
Groups eligible for supplementation			.079
good	7.2	0.0	
moderate	35.1	35.6	
poor	57.7	64.4	
Malaria prevention			.361
good	88.7	81.7	
moderate	8.2	14.4	
poor	3.1	3.8	
Hookworm prevention			.379
good	53.6	44.2	
moderate	33.0	37.5	
poor	13.4	18.3	

Community members

With regards to the knowledge at household level, less than 20 percent of respondents from the IA had good knowledge on various aspects of anaemia as compared to less than 6 percent in the CA. These aspects includes causes, symptoms, the effects and on some measures for the prevention and control of anaemia. Majority of the respondents seemed to have moderate knowledge in many of these parameters (table 4).

Table 4: Knowledge on anaemia among the community members

	IA (n=319) **%**	**CA** (n=322) **%**	P-value
Causes of anaemia			.000

good	11.0	2.2	
moderate	71.2	71.4	
poor	17.9	26.4	
Symptoms of anaemia			.006
good	4.1	0.6	
moderate	57.7	54.3	
poor	38.2	45.0	
Effects of anaemia			.006
good	2.2	0.0	
moderate	83.7	87.6	
poor	14.1	12.4	
Types of foods that can increase blood in the body			.000
good	19.7	5.9	
moderate	59.6	54.3	
poor	20.7	39.8	
Feeding practices for under five children			.000
good	10.3	0.0	
moderate	56.4	49.7	
poor	33.2	50.3	
Prevention and control of diseases associated with anaemia			.000
good	4.4	0.0	
moderate	52.4	42.5	
poor	43.3	57.5	

There was a significant difference in knowledge on various parameters between the two areas. Both areas had respondents with slightly good scores on the types of foods that are important in increasing blood in the body. About 20 percent of the respondents with good knowledge were from the IA and only 6 percent from the CA ($p < 0.001$). In the IA parameters which respondents had lowest scores include symptoms of anaemia, the effects and the prevention and control of diseases associated with anaemia. In the CA the only parameter where respondents had good score on knowledge (of 6%) was on the type of foods that can increase blood in the body.

Practices on the prevention and control of anaemia

Health workers

Health workers in the CA seemed to have good practices in many of the activities related to the prevention of anaemia than in the IA (table 5). In both areas about 90 percent of the health workers reported to provide health and nutrition education to patients who were anaemic. But when asked whether they provided health and nutrition education to the community, only 54 percent in the IA as opposed to 70 percent in the CA responded positively. Likewise, 79 percent in the IA and 89 percent in the CA admitted to provide advice on horticulture at community level.

Responding to the dose of iron and folic acid supplements they provide to the pregnant women, only 10 percent of the health workers in the IA and 27 percent in the CA, knew the correct dose. Regarding the duration to which pregnant women should be supplemented with iron and folic acid tablets, only 17 percent of health workers were supplementing pregnant women up to 6 weeks post delivery in the IA while only 11 percent did so in the CA ($p = 0.003$).

Table 5: Health workers practices for the control of anaemia

	IA (n=97) **%**	CA (n=104) **%**	p-value
Provision of health education to patients			.505
yes	90.7	93.3	
no	9.3	6.7	
Awareness creation to the community			.015
yes	53.6	70.2	
no	46.4	29.8	
Practice of giving advice on horticulture			.049
yes	79.4	89.4	
no	20.6	10.6	
Recommended suppl. dose to pregnant women			.010
good	10.3	26.9	
moderate	21.6	20.2	

low	68.0	52.9	
Duration of supplementing pregnant women			.003
good	17.5	11.5	
low	82.5	88.5	
Practice of providing supplements to the community			.000
yes	30.9	57.7	
no	69.1	42.3	

Community members

One of the practices mentioned was that of helping someone who is anaemic by sending to the health facility when found anaemic. About 51 percent of respondents in the IA and 36 percent in the CA reported that they would either send a relative to the health facility or provide him or her with foods that will help increase blood in the body if had symptoms of anaemia (table 6).

Table 6: Community members practices regarding anaemia prevention and control

	IA (n=319) %	**CA (n=322) %**	p-values
Measures to help someone who is anaemic			.000
good	51.4	35.9	
moderate	45.1	60.2	
poor	3.4	4.0	
Initial measures for prevention of anaemia			.000
good	23.5	10.2	
moderate	58.9	59.0	
poor	17.6	30.7	
Did attend meetings on anaemia			.003

yes	7.5	2.5	
no	92.5	97.5	
Sources of information on anaemia			
health workers	62.4	42.9	.000
radio	26.3	22.0	.205
TBAs	0.6	0.3	
leaflets, fliers brochures	0.0	0.3	
Practicing animal husbandry or poultry			.000
yes	83.7	68.9	
no	16.3	31.1	
Reasons for practicing animal husbandry or poultry			.001
source of meat only	14.2	25.3	
for both meat and selling	82.0	67.0	
only for selling	3.7	7.7	
Home yard gardening for			.130
vegetables	2.5	3.7	
fruits	32.0	26.1	
fruits and veget.	1.6	3.7	
no garden	63.9	66.5	
Family members wearing shoes			.000
yes	32.3	17.1	
no	67.7	82.9	
Presence of latrine			.000
yes	96.9	89.8	
no	3.1	10.2	

Responding to a question on initial steps to prevent the occurrence of anaemia before sending someone to a health facility, only 23 percent of the respondents in the IA and 10 percent in the CA demonstrated to take the desirable actions. These actions include the use of foods of animal origin, eating fruits and use of vegetables.

However, when asked to whether they ever attended any community meeting which were addressing the problem of anaemia, only 7 percent of the respondents in the IA and 3 percent in the CA reported to have attended such meetings. With regard to other sources of information on anaemia, health workers and the radio were the only sources of information. Health workers as a source were reported by 62 percent and 43 percent of

the respondents in the IA and CA, respectively ($p < 0.001$), while radio was source of information to 26 percent of respondents in the IA and in the CA 22 percent.

Regarding keeping animals or poultry at home, 84 percent of the respondents in the IA kept various types of small animals as compared to 69 percent in the CA ($p < 0.001$). Animals mostly kept were chicken and goats in both areas. Among the reasons given for keeping chicken, goats and other small animals, 14 percent of the respondents in the IA and 25 percent in the CA said it was a source of meat only. On the other hand, 82 percent of the respondents in the IA and 67 percent in the CA said it was for both selling and as a source of meat.

The presence of back yard gardening for either vegetables or fruits was very low. For vegetables only 3 percent of the households in the IA and 4 percent in the CA had back yard gardens, while 32 percent of the households in the IA and 26 percent in the CA had back yard gardening for fruits. Regarding having back yard gardening for both vegetables and fruits, only 2 percent of the households in the IA and 4 percent in the CA had back yard gardens for fruits and vegetables. Overall, 64 percent of the households in the IA and 66 percent in the CA had no back yard gardening for either fruits or vegetables.

Observations were made during the interviews to see if there was any member of the household wearing any shoes or sandals. It was observed that 32 percent of the household members were wearing shoes in the IA as opposed to 17 percent in the CA.

The latrine coverage was found to be high in both areas, 97 percent of the households had latrines in the IA and 90 percent in the CA.

Attitudes on anaemia

Community members

Enquiries were made to assess household's member's attitudes on several aspects related to the problem of anaemia. Generally in both areas they elicited having positive attitudes towards the use of supplements, vegetables and food in preventing anaemia (table 7).

With regards to the meetings about 75 percent of the respondents in the IA and 90 percent in the CA believed that attending meetings that talk about the problem of anaemia could help people to understand on how to prevent and control anaemia.

Table 7: Community members attitudes regarding anaemia

	IA (n=319) %	CA (n=322) %	p-values
Can food prevent anaemia			.000
yes	83.0	69.3	
no	16.9	30.7	
Do taking supplements prevent anaemia			.000
yes	72.1	55.5	
no	27.9	44.5	
Do eating vegetables and fruits prevent anaemia			.000
yes	90.0	79.2	
no	10.0	20.8	
Are meetings on anaemia helpful to reduce anaemia			.000
yes (+ attitude)	74.6	89.1	
no (- attitude)	25.4	10.9	

Food consumption pattern at household level

With regards to food consumption, staples were the main food group consumed regularly by most of the households visited in both areas (table 8) followed by foods of animal origin. The least regularly consumed food groups were the leguminous products and vegetables. Overall there were more regular consumers of most of the food groups in the CA than in the IA and the differences within most of the groups were highly significant with $p < 0.05$ in all five-food groups.

Table 8: Overall food consumption pattern at household level

	IA (n=319) %	CA (n=322) %	p-values

Staples				**.000**
	regular consumer	88	98	
	occasional consumer	11	2	
	never consumed	1	0	
Dark green leafy vegetables (DGLV)				**.006**
	regular consumer	18	29	
	occasional consumer	71	62	
	never consumed	11	9	
Legumes				**.000**
	regular consumer	8	27	
	occasional consumer	75	66	
	never consumed	17	7	
Fruits				**.005**
	regular consumer	22	32	
	occasional consumer	45	35	
	never consumed	33	33	
Foods of animal origin				**.000**
	regular consumer	33	53	
	occasional consumer	64	45	
	never consumed	3	2	

For the dark green leafy vegetables (DGLV) food group, cassava leaves were consumed regularly by only 17 percent of households in the IA as compared to 21 percent in the CA followed by amaranth and sweat potato leaves. Cowpea and pumpkin leaves were the least regularly consumed food items in both areas (table 9).

Table 9: FOOD CONSUMPTION PATTERNREPORTED BY COMMUNITY MEMBERS

		IA (n=319) %	CA (n=322) %	p-value
Dark green leafy vegetables (DGLV)				
Amaranth				**.005**
	regular consumer	15	25	
	occasional consumer	31	30	
	never consumed	54	45	
Cassava leaves				**.317**
	regular consumer	17	21	
	occasional consumer	37	39	
	never consumed	46	40	
Cowpea leaves				**.002**
	regular consumer	7	14	
	occasional consumer	19	24	
	never consumed	74	62	
Pumpkins leaves				**.000**
	regular consumer	5	2	
	occasional consumer	13	5	
	never consumed	82	93	
Sweat potato leaves				**.000**
	regular consumer	14	24	
	occasional consumer	26	31	
	never consumed	60	45	

Fruits	**Oranges**				**.133**
		regular consumer	4	5	
		occasional consumer	9	14	
		never consumed	87	81	
	Papaw				**.000**
		regular consumer	13	6	
		occasional consumer	28	20	
		never consumed	59	74	
	Baobab				**.001**
		regular consumer	20	34	
		occasional consumer	12	10	
		never consumed	68	56	
	Tamarind				**.000**
		regular consumer	14	5	
		occasional consumer	9	5	
		never consumed	77	90	
	Guava				**.875**
		regular consumer	3	3	
		occasional consumer	3	3	
		never consumed	94	94	
Foods of animal origin					
	Liver				**.110**
		regular consumer	4	6	
		occasional consumer	10	6	
		never consumed	86	88	
	Kidneys				**.074**
		regular consumer	1	2	
		occasional consumer	6	2	
		never consumed	93	96	
	Milk				**.000**
		regular consumer	30	44	
		occasional consumer	24	23	
		never consumed	46	33	
	Chicken				**.000**
		regular consumer	9	9	
		occasional consumer	35	20	
		never consumed	56	71	
	Sardines				**.758**
		regular consumer	45	47	
		occasional consumer	39	36	
		never consumed	16	17	
	Meat				**.835**
		regular consumer	23	22	
		occasional consumer	45	43	
		never consumed	32	35	

Of the fruit group, baobab, which is wild, fruits were the most frequently eaten fruits, 14 percent in the IA and 28 in the CA. Other types of fruits that include oranges, papaw, tamarind and guava were rarely consumed regularly by most of the households visited.

Sardines were regularly consumed by 45 percent of the household members in the IA and by 47 percent in the CA followed by milk with 30 percent in the IA and 44 percent in the CA. The least commonly consumed food items from foods of animal origin were kidneys, liver and chicken.

Discussion

Iron deficiency anaemia remains a public health problem especially for developing countries where women of reproductive age and children below five years of age are the most affected (ACC/SCN, 2000). Unlike vitamin A deficiency and Iodine Deficiency Disorders, prevention and control of IDA continues to lag behind despite the fact that it is the most prevalent nutritional deficiency in the world (Gillespie, 1998).

Strategies for prevention and control of iron deficiency and its anaemia include; supplementation of vulnerable groups with specific micronutrients and dietary improvement aimed at increasing supply and intake of food iron. Other strategies involve food fortification with suitable micronutrients and public health measures to control diseases that are associated with anaemia (Gillespie, 1998; Viteri, 1998).

Health and nutrition education is an important tool towards elimination of IDA for creating awareness amongst key actors including policy makers, health workers and the community at large (Guldan *et al*, 2000; Childs *et al*, 1997). The fact that IDA has no obvious physical manifestations, and the lack of widespread knowledge of serious consequences it has on human health to the decision-makers (UNICEF/UNU/WHO/MI, 1999), makes health and nutrition education an important tool for bridging this gape.

The findings of this study showed that health workers in the IA were more knowledgeable on the issues pertaining to anaemia than in the CA. Although there was a difference in knowledge between the two areas, the difference in many instances were not significantly high. This was observed in almost many of the aspects including knowledge on the causes, the effects and the preventive and control measures. Understanding of the basic information with regards to the problem of anaemia is necessary for the health workers to see the urgent need for addressing the problem by delivering correct massages to the community.

Community awareness of the problem of anaemia is a key to successful implementation of intervention programmes (FAO, 1997). Findings at the household level indicate that the IA had better knowledge compared to the CA especially in the areas related to the

types of foods important in increasing blood in the body. Understanding of the consequences of anaemia to people's health is a motivation towards increased efforts for prevention and control of anaemia. However, the majority of the respondents had moderate knowledge on the causes, symptoms of anaemia, its effects and on other preventive measures. This is a set back to successful implementation of nutrition intervention programmes.

Having positive attitudes on food related issues is an important factor for implementing health and nutrition education. A study by Thompson *et al* (1999) demonstrated that the impact of knowledge was less important than attitudes about a healthy diet especially in deciding what to eat. In this study, respondents at household level in the IA than in the CA had positive attitudes towards supplementation, effect of food in preventing anaemia, and the importance of vegetables and fruits in preventing anaemia. This can be a motive behind behavioural change for using supplements or eating vegetables and fruits not only as part of the meal but with more focused intention to prevent micronutrient malnutrition such as iron deficiency.

On the aspect of the practices, a majority of health workers demonstrated good practices. However, the validation as to whether this is true is hard to ascertain. In many aspects health workers form the CA seemed to have good practices than in the IA. With respect to giving supplements to pregnant women, many did not know the regimen required for iron and folic acid supplementation. Furthermore, many of the health workers in both areas were supplementing pregnant women until delivery as compared to 20 percent in the IA and 13 percent in the CA who were supplementing up to 6 weeks postpartum.

Routine iron supplementation is recommended for young children, adolescents, women of childbearing age and pregnant women where prevalence of anaemia in each of these populations are more than 40 percent (Stoltzfus *et al* 1998). Since the prevalence of anaemia in developing countries exceeds 40 percent, iron supplementation will remain the main stay of anaemia prevention especially to pregnant women. Health workers knowledge and practices with respect to supplementation are therefore, important in order

to reduce the problem of anaemia to the vulnerable groups. Health workers knowledge on groups eligible for supplementation was found to be lacking in this study.

Contact between patients and health workers create an opportunity for counselling on many health aspects including nutrition issues. It was observed in this study that many of the health workers did provide health and nutrition education to patients at the health facility but not to the community especially in the IA. This finding suggests that prevention and control of anaemia is still facility oriented and that there is little involvement of the community in the prevention of anaemia.

Nutrition education helps to promote desirable food behaviour and nutrition practices (Creed-Kanashiro *et al*, 2000; FAO, 1997). Therefore, advice on dietary diversification through promotion of production and consumption of foods rich in iron and folate is an important aspect in the control of anaemia (Viteri, 1998). The majority of health workers in the CA seemed to provide information on horticulture than in the IA although they felt that they did not have enough knowledge on this area. Providing health workers with basic knowledge on horticulture should be part of the control programme.

Providing the community with information and advice on anaemia related issues increases their knowledge and probably their practice as well. Community meetings are such channels, which can be used to provide information to the community. However, there were quite a few (8% in IA and 3% in CA) in both areas who claimed to have attended community meetings, which did address the problem of anaemia. Contrary to community meetings being not reliable source of information, health workers and radios were the main source of information. Fliers, leaflets, brochures or TBAs were almost non-existent as sources of information. The need is therefore obvious to strengthen the IEC component of the programme.

Although majority of the respondents at household's level in both areas practised animal husbandry/poultry, the usefulness of this practice for anaemia control is questionable given the reasons as to why they practised animal husbandry/poultry. Among the reasons

given for both areas included keeping them as a source of meat as well as for financial purposes.

Consumption of fruits and vegetables is associated with increase in vitamin C, folic acid and iron (Rao *et al*, 2001). The use of fruits and vegetables is highly advocated as it serves the purpose of providing these basic micronutrient for the prevention IDA. Back yard gardening in these study areas did not favour this intervention strategy. Overall 64 percent of the households in the IA and 66 percent in the CA did not have back yard gardens for fruits and vegetables. A substantial number of households had back yard gardens for fruits (32 % in the IA and 26 % in the CA). However, very few households had back yard gardens for vegetables and fruits or fruits only.

The main sources of iron in most developing countries are the dietary iron from foods of plant origin. However, iron from plant sources is of the non-haem type, which is not readily bioavailable. Plant sources also contain inhibitors of iron absorption like phytates and polyphenols (Bhargava *et al*, 2001; Gillespie, 1998; ACC/SCN, 1997) making the matter even worse. Results from this study based on 7 days dietary recall indicate that staples were the main food group consumed regularly by most of the households in both areas followed by foods of animal origin.

Furthermore, findings from foods of animal origin indicates that milk was among foods consumed regularly by 30 percent and 44 percent of the households in the IA and CA, respectively. Milk, although can be grouped among food sources of animal origin, it contains calcium, which is an inhibitor for iron absorption (Fairweather-Tait, 1995; Svanberg, 1995). Therefore, high consumption of milk can increase the risk of one becoming anaemic. Overall, other than staples many of the households were occasional consumers.

Conclusion

The low percentage of respondents with good knowledge both in the IA and CA is an indication that translation of knowledge to practice will remain the key obstacle to

successful implementation of health and nutrition programme. There is a clear indication that capacity building and empowerment is essential for the health workers to be able to translate the knowledge they have acquired into desirable practices.

Focus should be directed towards involving change agents from different sectors and the local people in various activities. These include developing communication strategies, which will bring upon active participation of all key actors. The communication strategies should also aim at increasing knowledge and awareness of the public and of policy makers, and promote desirable food behaviour and nutrition practices by involving active participation of the community members.

References:

ACC/SCN. The 3rd Report on the World Nutrition Situation. A report compiled from information available to the ACC/SCN, December 1997: 34-40.

ACC/SCN. Fourth Report on The World Nutrition Situation. Nutrition Through the Life Cycle. January 2000: 23-27.

Beasley NMR, Tomkins AM, Hall A, Lorri W, Kihamia CM, Bundy DAP. The Impact of weekly iron supplementation on the iron status and growth of adolescent girls in Tanzania. Tropical Medicine and International Health, 2000; **5 (11)**: 794-799.

Bhargava A, Bouis HE, Scrimshaw NS. Dietary Intake and Socioeconomic Factors Are Associated with the Haemoglobin Concentration of Bangladesh Women. J. Nutr. 2001; **131**: 758-764.

Childs F, Aukett A, Darbyshire P, Ilett S, Livera LN. Dietary education and iron deficiency anaemia in inner city. Archives of Disease in Childhood, 1997; **76**:144-147.

Creed-Kanashiro HM, Uribe TG, Bartolini RM, Fukumoto MN, Lopez TT, Zavaleta MN, Bentley ME. Improving Dietary Intake to prevent Anaemia in Adolescent Girls through Community Kitchens in a Periurban Population of Lima, Peru. J Nutr, 2000; **130**: 459S-461S.

Fairweather-Tait SJ. Bioavailability of Iron. *In*: Nestel P eds Iron Interventions for Child Survival. Proceedings of the 17-18 May 1995 conference, London. Opportunities for Micronutrient Interventions, Washington DC, USA.

FAO. Agriculture, food and nutrition for Africa: A resource book for teachers of Agriculture, Food and Nutrition Division, Rome, 1997.

FAO. Preventing micronutrient malnutrition: A Guide to food- Based Approaches. A manual for policy makers and programme planners: ILSI Press Washington, DC, 1997.

Gillespie S. Major Issues in the Control of Iron Deficiency. The micronutrient Initiative and UNICEF, 1998.

Guldan GS, Fan HC, Ma X, Ni ZZ, Xiang X, Tang MZ. Culturally Appropriate Nutrition Education Improves Infant Feeding and Growth in Rural Sichuan, China. J. Nutr. 2000; **130**: 1204-1211.

Howson CP, Kennedy E, and Horwitz A. Prevention of micronutrient deficiencies: tools for policymakers and public health workers. Institute of Medicine, National Academy Press, Washington DC, 1998.

Kavishe FP, Mushi SS. Nutrition-Relevant Action in Tanzania. UN ACC/SCN Country Case Study, XV Congress of the International Union of Nutrition Sciences, Sept. 26th to Oct. 1st 1993, Adelaide, Australia.

Mnyika KS. Anaemia in Tanzania. A situation analysis. A consultancy report to Tanzania Food and Nutrition Centre, 1991, Dar es Salaam, Tanzania. TFNC report **no. 1436**.

Partnership for Child Development (PCD). The Health and Nutrition Status of Schoolchildren in Africa: evidence from school-based health programmes in Ghana and Tanzania. Transactions of The Royal Society of Tropical Medicine and Hygiene, 1998; **92**: 254-261.

Rao S, Yajnik SC, Kanade A, Fall CHD, Margetts BM, Jackson AA, Shier R, Joshi S, Rege S, Lubree H, Desai B. Intake of Micronutrient Rich Foods in Rural Indian Mothers Is Associated with the Size of Their Babies at Birth: Pune Maternal Nutrition Study. J. Nutr. 2001; **131**: 1217-1224.

Stoltzfus R. Defining Iron-Deficiency Anaemia in Public Health Terms: A Time for Reflection. J. Nutr. 2001; **131**: 565S-567S.

Stoltzfus R, Dreyfuss M. Guidelines for the Use of Iron Supplementation to Prevent and Treat Iron Deficiency Anaemia. The International Nutrition Anaemia Consultative Group (INACG/WHO/UNICEF), 1998, Washington, D.C., USA.

Stoltzfus RJ, Albonico M, Chwaya HM, Tielsch JM, Schulze KJ, Saviol L *et al*. Effect of the Zanzibar School based deworming programme on iron status of children; Am J Clin Nutr, June 1998; **68 (1)**: 179-86.

Svanberg U. Dietary Interventions to Prevent Iron Deficiency in Pre-school Children. *In* Nestel P eds. Iron Interventions for Child Survival. Proceedings of the 17-18 May 1995 conference, London. Opportunities for Micronutrient Interventions, Washington DC, USA.

Tanzania Food and Nutrition Centre. Nutritional Anaemia Training Module for Extension Workers, 1995, Dar es Salaam, Tanzania. TFNC report **no. 1730**.

Tatala S, Svanberg U, Mduma B. Low dietary iron availability is a major cause of anaemia: a nutrition survey in the Lindi district of Tanzania. Am J Clin Nutr 1998; **68**: 171-178.

Thompson RL, Margetts BM, Speller VM, McVey D. The Health Education Authority's health and lifestyle survey 1993; who are the low fruit and vegetable consumers. J Epidemiol Community Health, 1999; **53**: 294-299.

UNICEF/UNU/WHO/MI. Preventing Iron Deficiency in Women and Children: Technical Consensus on Key Issues. Technical workshop, October 7-9, 1998. Boston and Ottawa: International Nutrition Foundation and MI, 1999.

Viteri, FE. Prevention of Iron Deficiency: *In:* Howson CP, Kennedy E, Horwitz A. Prevention of micronutrient deficiencies: tools for policymakers and public health workers. Institute of Medicine, National Academy Press, Washington DC, 1998: 45-102.

Annex 1a: Haemoglobin levels for children below five years (WHO cut-off points).

	Year			
	1997	1998	1999	2000
Total (from)	**15 sites**	**10 sites**	**4 sites**	**1 site**
n	6311	7413	770	70
severe % (n)	12.9 (812)	28.2 (2130)	44.0 (339)	34.3 (24)
moderate % (n)	34.0 (2143)	51.9 (3844)	45.1 (347)	51.4 (34)
mild % (n)	14.4 (910)	6.6 (488)	5.5 (42)	10.0 (7)
Total anaemic % (n)	**61.2 (3865)**	**87.2 (6462)**	**94.5 (728)**	**95.7 (67)**
Normal % (n)	38.8 (2446)	12.8 (951)	5.5 (42)	4.3 (3)
Mean ± s.d.	**10.13 ± 2.69**	**8.31 ± 2.61**	**7.38 ± 2.24**	**7.65 ± 2.36**
Iramba (IA)				

n	241	377	-	-
severe % (n)	22.0 (53)	40.3 (152)	-	-
moderate % (n)	36.9 (89)	39.3 (148)	-	-
mild % (n)	13.7 (33)	9.0 (34)	-	-
Total anaemic % (n)	**72.6 (175)**	**88.6 (334)**	-	-
normal % (n)	27.4 (66)	11.4 (43)	-	-
Mean ± s.d.	**9.44 ± 2.88**	**7.71 ± 2.72**	-	-
Kondoa (CA)				
n	110	207	71	70
severe % (n)	0.9 (1)	22.2 (46)	15.5 (11)	34.3 (24)
moderate % (n)	46.4 (51)	45.9 (95)	66.2 (47)	51.4 (36)
mild % (n)	24.5 (27)	10.6 (22)	15.5 (11)	10.0 (7)
Total anaemic % (n)	**71.8 (79)**	**78.7 (163)**	**97.4 (69)**	**95.7 (7)**
normal % (n)	28.2 (31)	21.3 (44)	2.8 (2)	4.3 (3)
Mean ± s.d.	**10.46 ± 1.75**	**8.82 ± 2.59**	**8.73 ±1.73**	**7.65 ± 2.36**

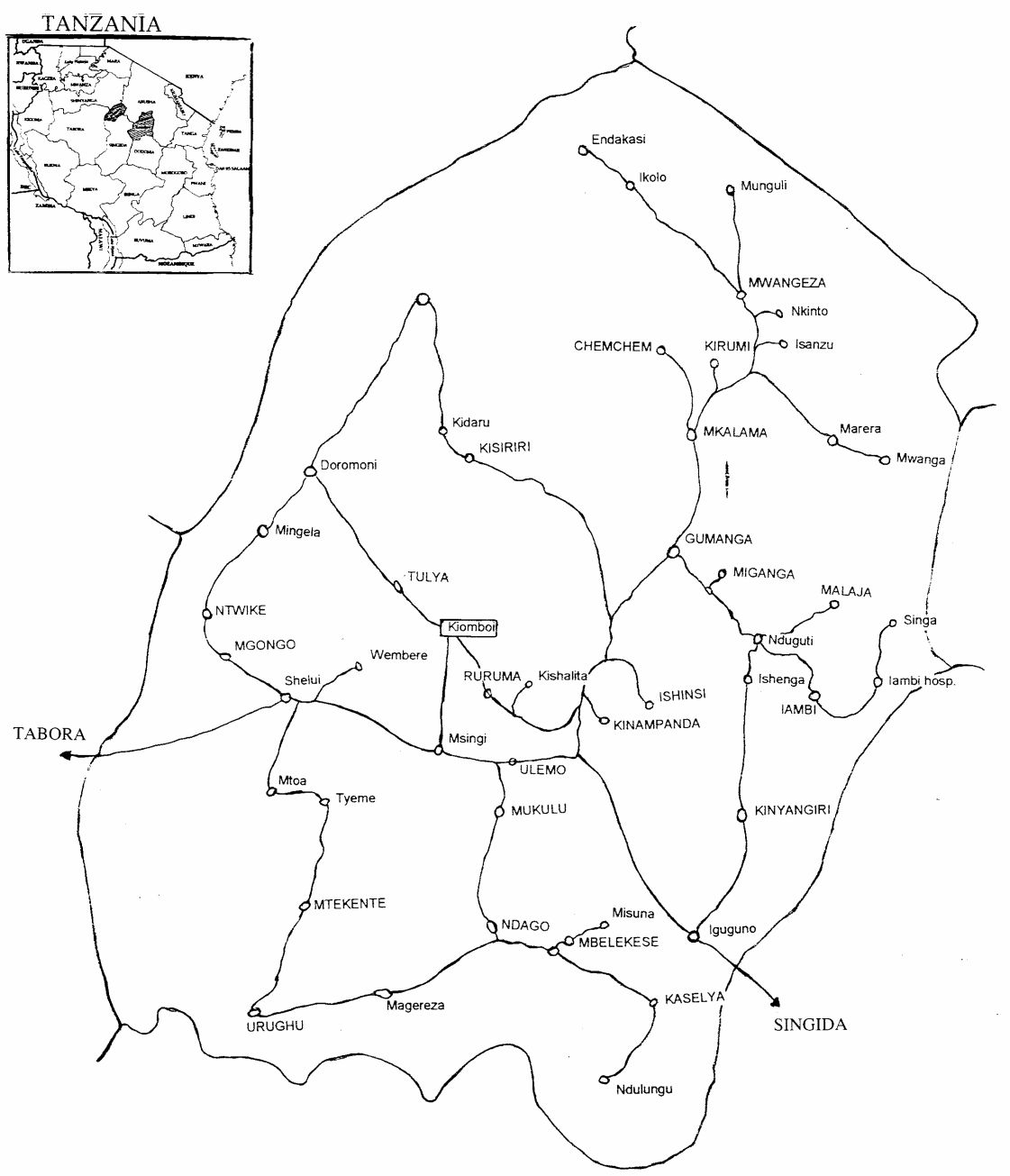
Annex 1b: Haemoglobin levels for for pregnant women (WHO cut-off points).

	Year			
	1997	**1998**	**1999**	**2000**
Total (from)	**15 sites**	**11 sites**	**4 sites**	**1 site**
n	2646	2121	562	70
severe % (n)	8.8 (233)	9.0 (191)	10.9 (61)	7.1 (5)
moderate % (n)	48.9 (1294)	52.2 (1108)	61.2 (344)	68.6 (48)
mild % (n)	14.8 (391)	13.0 (276)	13.3 (75)	17.1 (12)
Total anaemic % (n)	**72.5 (1918)**	**74.3 (1575)**	**85.4 (480)**	**92.9 (65)**
Normal % (n)	27.5 (728)	25.7 (546)	14.6 (82)	7.1 (5)
Mean ± s.d.	**9.70 ± 2.28**	**9.56 ± 2.00**	**9.22 ± 1.73**	**9.43 ± 1.26**
Iramba (IA)				
n	78	49	-	-

severe % (n)	12.8 (10)	14.3 (7)	-	-
moderate % (n)	37.2 (29)	53.1 (26)	-	-
mild % (n)	17.9 (14)	12.2 (6)	-	-
Total anaemic % (n)	**67.9 (53)**	**79.6 (39)**	**-**	**-**
Normal % (n)	32.1 (25)	20.4 (10)	-	-
Mean ± s.d.	**10.06 ± 3.12**	**9.05 ± 2.06**	-	-
Kondoa (CA)				
n	196	192	160	70
severe % (n)	3.1 (6)	2.1 (4)	0.0 (0)	7.1 (5)
moderate % (n)	48.5 (95)	65.1 (125)	65.0 (104)	68.6 (48)
mild % (n)	20.9 (41)	9.9 (19)	20.6 (33)	17.1 (12)
Total anaemic % (n)	**72.4 (142)**	**77.1 (148)**	**85.6 (137)**	**92.9 (65)**
Normal % (n)	27.6 (54)	22.9 (44)	14.4 (23)	7.1 (5)
Mean ± s.d.	**10.17 ± 1.60**	**9.60 ± 1.47**	**9.87 ± 0.81**	**9.43 ± 1.26**

Annex 2a:

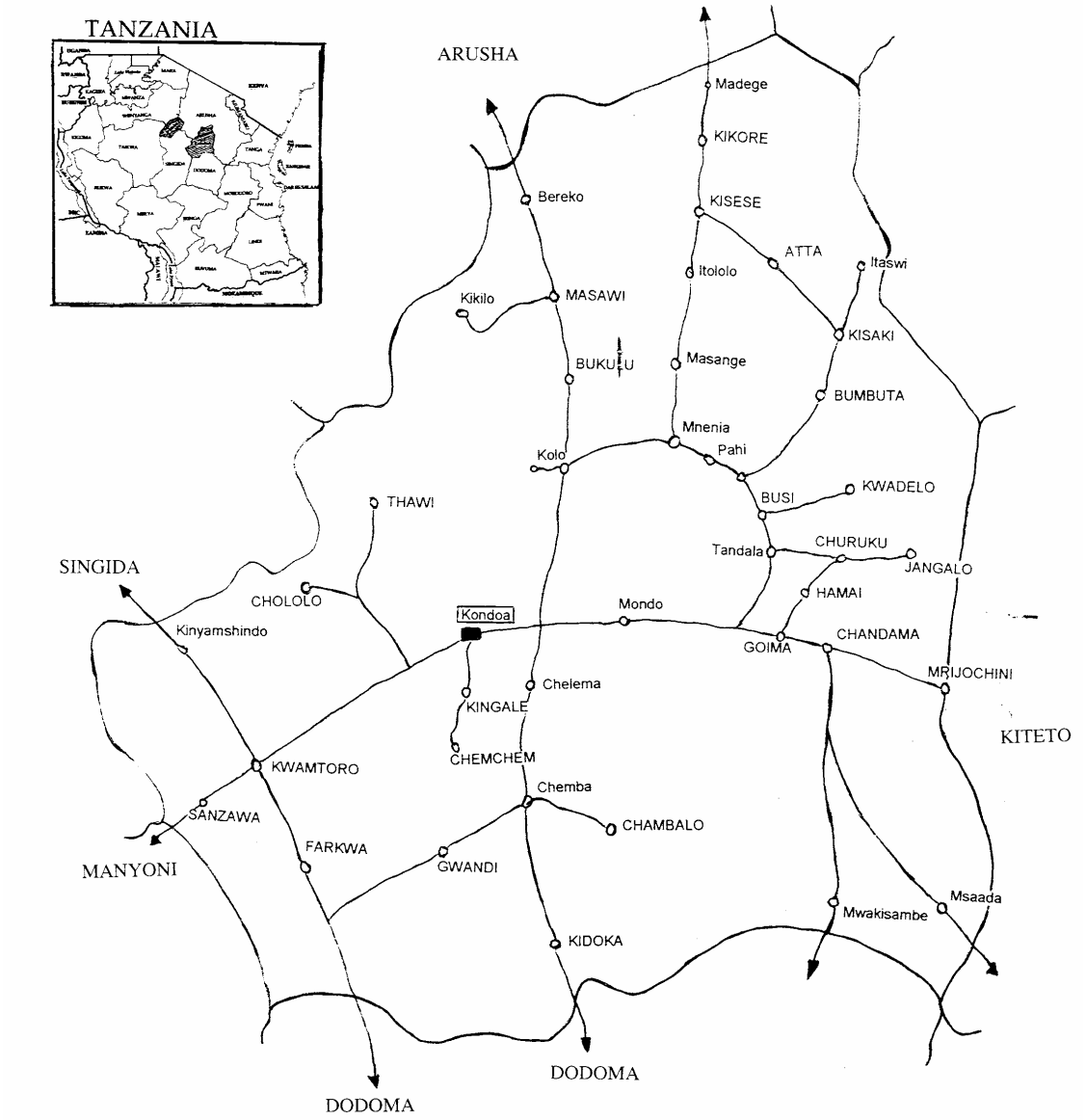
IRAMBA DISTRICT



NB: Villages visited in capital letters.

Annex 2b:

KONDOA DISTRICT



NB: Villages visited in capital letters.

Annex 3a:
Health facilities and villages visited in Iramba district:

Division	**Ward**	Health facility visited	**Village visited**
1.Nduguti	1. Mwanga 2. Nduguti 3. Gumanga 4. Ilunda	1. Malaja dispensary 2. Miganga dispensary 3. Gumanga dispensary 4. Iambi Lutheran Hospital	1. Malaja 2. Miganga 3. Gumanga 4. Iambi

2. Kirumi	5. Nkinto ” 6. Mwangeza 7. Ibaga 8. Mpambala	5. Nkinto dispensary 6. Kirumi dispensary 7. Mwangeza dispensary 8. Mkalama Health Centre 9. Chemchem dispensary	- 5. Kirumi 6. Mwangeza 7. Mkalama 8. Chemchem
3 Kinyangiri	9. Kinyangiri 10. Iguguno ” 11. Msingi	10. Kinyangiri Health Centre 11. Iguguno R/C dispensary 12. Iguguno govt dispensary 13. Ishinsi dispensary	9. Kinyangiri - - 10. Ishinsi
4. Kinampanda	12. Kinampanda 13. Kyengege 14. Ulemo”	14. Kinampanda Lutheran disp. 15. Ulemo dispensary 16. Mukulu dispensary	11. Kinampanda 12. Ulemo 13. Mkulu
5. Ndago	15. Ndago 16. Urughu 17. Mtekente 18. Mbelekese 19. Kaselya	17. Ndago Health Centre 18. Urughu dispensary 19. Mtekente dispensary 20. Mbelekese dispensary 21. Kaselya dispensary	14. Ndago 15. Urughu 16. Mtekente 17. Mbelekese 18. Kaselya
6. Shelui	20. Shelui ” 21. Ntwike 22. Mtoa	22. Shelui dispensary 23. Mgongo Health Centre 24. Ntwike dispensary 25. Mtoa dispensary	- 19. Mgongo 20. Ntwike -
7. Kisiriri	23. Kiomboi 24. Kisiriri 25. Tulya	26. Ruruma dispensary 27. Kisiriri dispensary 28. Tulya dispensary	21. Ruruma 22. Kisiriri 23. Tulya

Annex 3b:
Health facilities and villages visited in Kondoa district

Division	Ward	Health facility visited	Village visited
1. Kolo	1. Changaa 2. Thawi 3. Kolo	1. Chololo dispensary 2. Thawi dispensary 3. Kolo dispensary	1. Chololo 2. Thawi -
2. Kwamtoro	4. Kwamtoro	4. Kwamtoro Health Centre	3. Kwamtoro

	5. Sanzawa	5. Sanzawa dispensary	4. Sanzawa
3. Farukwa	6. Farukwa 7. Gwandi	6. Farkwa dispensary 7. Gwandi dispensary	5. Farukwa 6. Gwandi
4. Goima	8. Goima ” 9. Chemba ” 10. Mrijo 11. Chandama	8. Goima dispensary 9. Hamai Health Centre 10. Kidoka dispensary 11. Chambalo dispensary 12. Mrijochini dispensary 13. Chandama dispensary	7. Goima 8. Hamai 9. Kidoka 10. Chambalo 11. Mrijochini 12. Chandama
5. Mondo	12. Mondo 13. Paranga 14. Jangalo ” 15. Dalai	14. Mondo dispensary 15. Kelema dispensary 16. Jangalo dispensary 17. Churuku dispensary 18. Tandala dispensary	- - 13. Jangalo 14. Churuku -
6. Pahi	16. Pahi 17. Busi 18. Kwadelo 19. Bumbuta ” ”	19. Pahi dispensary 20. Busi Health Centre 21. Kwadelo dispensary 22. Bumbuta dispensary 23. Itaswi dispensary 24. Kisaki dispensary	- 15. Busi 16. Kwadelo 17. Bumbuta - 18. Kisaki
7. Bereko	20. Bereko ” ” 21. Kisese ” ” 22. Mnenia 23. Masange ”	25. Bereko dispensary 26. Bukulu dispensary 27. Masawi dispensary 28. Kisese Health Centre 29. Atta dispensary 30. Kikore dispensary 31. Mnenia dispensary 32. Masange dispensary 33. Itololo dispensary	- 19. Bukuli 20. Masawi 21. Kisese 22. Atta 23. Kikole - - -
8. Kondoa mjini	24. Kingale ”	34. Kingale dispensary 35. Chemchem Lutheran disp.	24. Kingale 25. Chemchem

Annex 4a: INTERVIEW QUESTIONNAIRE FOR THE HEALTH WORKERS

We are conducting a study in your health facility to find out how do you know about, and what activities are you doing in order to prevent and control anaemia in the community. The only way to find out is to ask you, as you are the providers of such services. Your honest and correct answers are important, as the findings obtained in this study will help to make improvements of the intervention measures and hence reduce the prevalence of anaemia in the community.

We promise that the information you provide will be treated confidential and that the outcome of the findings will be communicated to you through the district health management team.

Questionnaire number [ ]
Date of interview ……/……./2000
Name of the Interviewer ……

SECTION A: IDENTIFICATION:

W-1. District …….

W-2. Name of the health facility……..

W-3. Type of the facility
1. [ ] Dispensary,
2. [ ] Health centre,
3. [ ] Hospital
4. [ ] Others, mention …….....

W-4. Sex of the respondent:
1. [ ] Female
2. [ ] Male

W-5. Age of the respondent:……

W-6. Position held at the time of interview
1. [ ] incharge of the health facility
2. [ ] incharge of the MCH services
3. [ ] Others .....

W-7. Education level (record number of years in school and or collages) …….....

W-8. Qualification
1. [ ] Nurse Attendant,
2. [ ] Nurse Auxiliary,
3. [ ] Nurse Midwife
4. [ ] Nursing Officer,
5. [ ] Public Health Nurse,
6. [ ] Rural Medical Aid
7. [ ] Medical Assistant
8. [ ] Assistant Medical Officer
9. [ ] Medical Officer
10. [ ] MCH Aid
11. [ ] Trained Nurse
12. [ ] Health Officer/Assistant
13. [ ] Laboratory Technician

W-9. How many years have you been working? ……..years

SECTION B

QUESTIONS	OPTIONS	**SCORES** **1. Good** **2. Moderate** **3. Low** **9. Not appl.**

W-10. After completion of your professional education, have you ever attended any nutritional anaemia training? 1. [ ] Yes, 2. [ ] No If the answer is yes, ask question W-11	1. [ ] Yes 2. [ ] No	[ ]
W-11. If the answer is **yes**, which year did you attend the training?…….	9. [ ] not applicable	[ ]
W-12. What do you understand by the term **anaemia**? 1. Reduced number of RBCs' 2. Reduced concentration of Hgb in the RBCs' 3. Both of the above answers 4. I don't know/remember 5. Others, mention ……	1. [ ] option 1 and 2 2. [ ] option no.1 or no. 2 3. [ ] only option 4 and/or 5	[ ]
W-13. Would you tell me the **causes** of anaemia? 1. Inadequate intake of foods rich in specific nutrients like iron, folic acid and vitamin C 2. Diseases especially worm infestation, malaria, schistosomiasis, diarrhoea and respiratory infections 3. Increased physiological demand such as it occurs in pregnancy, childhood and adolescents 4. Intake of foods which contain iron absorption inhibitors such as tannins, phytates and oxalates 5. Congenital diseases such as sickle cell 6. Bleeding as it occurs during child birth and in gastrointestinal bleeding and in accidents 7. Having food taboos which restrain vulnerable groups from eating nutritious foods 8. Others reasons, mention ……..	1. [ ] 4 or more options of 1-7 2. [ ] 2 – 3 options of 1-7 3. [ ] only 1 opt. and/or 8	[ ]
W-14. Can you tell me as far as you can remember the ill **effects** an individual can have as a result of being anaemic? 1. Impaired cognitive performance and learning ability in children 2. Poor pregnancy outcomes like low birth weight, abortions, and premature deliveries 3. Increased susceptibility to infections because of the decreased immunity 4. Reduced work capacity 5. Increased maternal mortality 6. Dizziness, palpitations, swelling of the lower limbs or of the whole body 7. Death 8. Other effects, mention …….	1. [ ] 4 or more opt. Of 1-7 2. [ ] 2 – 3 options of 1-7 3. [ ] only 1 option and/or 8	[ ]
W-15. Some groups of people are more susceptible to develop anaemia than others are. Could you tell me what these **risk groups** are? 1. Preterm babies 2. Low birth weight babies 3. Normal children below 2 years of age	1. [ ] 3 or more opt. of 1-6 2. [ ] 2 options of 1-6	[ ]

4. Adolescents 5. Pregnant women 6. *Sickle cell* patients 7. Other groups, mention ……	3. [ ] only 1 option and/or 7	
W-16. Why do you think a **pregnant woman** is among the susceptible groups to develop anaemia? 1. Because of the expansion of the red cell mass 2. Because of the growing foetus and the placenta 3. Because of the depleted iron stores especially if they have a closely spaced pregnancies 4. I do not know 5. Others reasons, mention ……..…….	1. [ ] option 1, 2 and 3 2. [ ] options 1 or 2 of 1-3 3. [ ] option 4 and or 5	[ ]
W-17. Could you tell me as far as you can remember the most practical ways, which can be used to **prevent and control** (nutritional) anaemia? 1. Supplementation of vulnerable groups with iron and folic acid 2. Promotion of production and consumption of foods rich in iron, folic acid and vitamin C 3. Railing of animal husbandry and poultry. 4. Strengthen preventive measures related to environmental sanitation in order to prevent diseases such as worms, schistosomiasis, diarrhoea together with the use of bed nets to prevent malaria 5. Advocate the use of foods which are fortified with iron and folic acid 6. promotion of exclusive breast feeding up to the age of 4-6 months and continue breast feeding for 2 years and beyond 7. Others, mention…….	1. [ ] 4 or more opt. of 1-6 2. [ ] 2-3 options of 1-6 3. [ ] only one opt. and/or 5	[ ]
W-18. Would you please tell me which **foods** do you remember that are rich in iron and folic acid? 1. Foods of **animal origin** ; Meat, eggs, fish, liver, kidneys and poultry 2. Foods of **plant origin** such as; Dark green leafy vegetables, pulses, some fruits, maize and other cereals 3. Exogenous sources From fortified foods and from cooking vessels 4. Others foods, please mention ……..	1. [ ] options 1, 2 and 3 2. [ ] 1 or 2 options of 1-3 3. [ ] only option 4	[ ]
W-19. Why do you think it is advisable for people to eat foods, which are **rich in vitamin C**, especially fruits during meals? 1. It enhances iron absorption 2. I don't remember/ know 3. Other reasons, mention, ……..…..	1. [ ] option 1 3. [ ] option 2 and or 3	[ ]

W-20. What is the **role of breast-feeding** in the preventing **either** the **mother** or the **baby** from becoming anaemic? 1. Breast feeding especially exclusive breast feeding prolongs lactational amenorrhoea 2. helps the uterus to contract thus minimizing blood loss 3. Exclusive breast-fed babies are at advantage because the iron in breast milk is wholly absorbed 4. I do not remember 6. Other reasons, mention …….…….	1. [ ] option 1, 2 and 3 2. [ ] 2 options of 1-3 3. [ ] only 1 opt. and/or 4 and/or 5	[ ]

SECTION C:

W-21. Do you normally **provide health and nutrition education** to patients? If the answer is yes , ask question W-22	1. [ ] Yes (go to W-22) 2. [ ] No	[ ]
W-22. What can you comment on the **time you spent** providing health and nutrition education to patients?	1. [ ] Time is enough 2. [ ] I cannot decide 3. [ ] Time is not enough 9. [ ] Not applicable	[ ]
W-23. Have you been involved in **providing health and nutrition education to the community?** If the answer is yes, continue with W-24	1. [ ] Yes (go to W-24) 2. [ ] No	[ ]
W-24. Which **methods** have you been using to delivery health and nutrition education to the community? 1. Face to face 2. Community meetings 3. Population theatres or drama groups 4. Other methods, mention …….……. 9. Not applicable		1. [ ] 2. [ ] 3. [ ] 4. [ ] 9. [ ]
W-25. Do you **agree** that providing health and nutrition education to the community members' can have an impact in reducing the prevalence of anaemia in the community? If the answer is **no**, ask question W-26	1. Agree 2. Uncertain 3. Disagree (go to W-26)	[ ]
W-26. If you **disagree**, could you please tell me why do you think so …… …… ……	9. [ ] Not applicable	[ ]
W-27. Do you think that you have **enough time** to provide health and nutrition education to the community?	1. [ ] Yes 2. [ ] I cannot judge 3. [ ] No 4. [ ] not applicable	[ ]
W-28. At your working area, do you normally advice people who come to practice **home gardening** and **animal husbandry**? If the answer is **yes**, ask question W-29	1. [ ] Yes (then ask W-29) 2. [ ] No	[ ]

W-29 Do you feel that promoting production and consumption of horticultural foods is part of your responsibility?	1. [ ] Yes 2. [ ] I cannot decide 3. [ ] No	[ ]

SECTION D:

W-30. In Tanzania what are the **population groups** eligible for supplementation? 1. Preterm babies 2. Low birth weight babies 3. Normal children below two years of age 4. Adolescents 5. Pregnant women 6. Sickle cell patients	1. [ ] 3 or more options 2. [ ] only 2 options 3. [ ] only 1 option	[ ]
W-31. What is the recommended **supplementation regimen** for pregnant women in Tanzania? (iron tablets 200mg once a day, and folic acid 1.0/5mg once a day) Record the answer and score …… 1. [ ] Correct for iron tablets 2. [ ] Correct for folic acid tablets 3. [ ] Not correct for iron tablets 4. [ ] Not correct for folic acid tablets	1. [ ] option 1 and 2 2. [ ] option 1 or 2 3. [ ] option 3 and/or 4	[ ]

W-32. For **how long** do you supplement a pregnant woman with iron and folic acid at your health facility? 1. As soon as pregnancy is diagnosed up to six weeks after delivery 2. Throughout pregnancy until delivery 3. Only when she is diagnosed as anaemic 4. Other, mention ……..….	1. [ ] option 1 2. [ ] option 2 or 3 3. [ ] option 4	[ ]
W-33. As a health worker, what do you think is your **role** in the **supplementation programme** in order to prevent and control anaemia? 1. Ensure availability of supplements at all times 2. Give the right supplementation regimens to the specific risk groups 3. Counselling of clients on the importance of supplements and side effects 4. Educate and counsel clients on the acquisition and taking of the supplements as prescribed by health workers 5. Other role, mention ……	1. [ ] 3 options of 1-4 2. [ ] 2 options of 1-4 3. [ ] only 1 option and/or 5	[ ]
W-34. In an area where **malaria** is a problem, what would you tell the community in order to prevent and control malaria? 1. Prevent mosquito bites through the use of repellents, mosquito nets, wire gauze on the windows and doors 2. Eradicate mosquito through use of insecticide, and clearing of bushes 3. Others, mention …..…….……	1. [ ] option 1 and 2 2. [ ] options 1or 2 3. [ ] only option 3	[ ]

W-35. What are the preventive measures will you educate your community in order to prevent **hookworm** infestation? 1. Importance of having and using latrines 2. Use of shoes whenever possible 3. Other, mention ……..	1. [ ] option 1 and 2 2. [ ] option 1 or 2 3. [ ] option 3	[ ]
W-36. Do you normally **provide supplements** (iron and folic acid tablets) to susceptible groups in the **community**?	1. [ ] Yes 2. [ ] No	[ ]
W-37. What **problems** have you been facing in the whole process of supplementing and the use of iron and folic acid tablets? 1. Non availability of supplements 2 Non attendance, late booking or irregular attendance of the pregnant women to the clinic 3. Poor compliance to the supplements as advised by health workers 4. Poor knowledge , attitude and practice of the health workers on supplementation activities 5. Others, mention ……..…… 6. Pregnant women do not want to use the supplements because of the side effects		1. [ ] 2. [ ] 3. [ ] 4. [ ] 5. [ ] 6. [ ] 7. [ ]
W-38. Lastly, do you have any **comments or advice** you would like to give to the ministry of health (MoH) or Tanzania Food and Nutrition Centre (TFNC) in order to reduce the problem of anaemia in the country? …… ……		

Thank you for your time and co-operation.

Annex 4b: INTERVIEW QUESTIONNAIRE FOR THE HOUSEHOLDS

We are conducting a study in your village to find out what do you know about, and what activities are you doing in order to prevent and control anaemia in the community. The only way to find out is to ask you as you are part of the community experiencing the problem, and you play a major role in preventing and controlling the problem of anaemia. Your honest and correct answers are important, as the findings obtained in this study will help to make improvements of the intervention measures and hence reduce the prevalence of anaemia in the community.

We promise that the information you provide will be treated confidential and that the outcome of the findings will be communicated to you through the district health management team.

Questionnaire number [ ]
Date of interview ……../……../2000
Name of the Interviewer …….

SECTION A: IDENTIFICATION

C-1. District …….....

C-2. Name of the village ……

C-3. Ten cell leader …….....

C-4. Sex of the respondent
1. [ ] Female
2. [ ] male

C-5. Age of the respondent ……..

C-6. Marital status:
1. [ ] single
2. [ ] married
3. [ ] widow
4. [ ] divorced
5. [ ] cohabiting

C-7. Number of years in school …….

C-8. Occupation
1. [ ] subsistence farmer
2. [ ] petty business women/man
3. [ ] civil servant
4. [ ] student
5. [ ] unemployed
6. [ ] others, please could you mention ……
7. [ ] others, please mention …….

C-9. Total number of family members living together ……

SECTION B

QUESTIONS	OPTIONS	SCORES 1. Good 2. Moderate 3. Low 4. Not appl.
C-10. Please, would you tell me what do you understand by the term anaemia (*upungufu wa damu*)? ……. …….	1. [ ] Yes 2. [ ] No	[ ]
C-11. Could you please tell me what are the **reasons** that makes people become anaemic (*upugufu wa damu*)? 1. Inadequate intake of foods rich in iron 2. Diseases such as malaria, schistosomiasis, worm infestation, respiratory diseases and diarrhoea 3. Increased physiological demands especially during pregnancy and to preterm babies; children and adolescents 4. Poverty 5. Bleeding as it occurs in accidents or during delivery 6. I do not know 7. Others, mention …….	1. [ ] 3 or more opts of 1-5 2. [ ] only 2 options of 1-5 3. [ ] only 1 opt. and/or 6 and or 7	[ ]
C-12. Would you please tell me the **symptoms** of which an anaemic person can have? 1. paleness in the conjunctiva, lips, gums, tongue, in the nail beds, palms and in the skin 2. dizziness, headaches and heart palpitations 3. tiredness and general body weakness 4. swelling of the body especially the lower limbs 5. difficult in breathing 6. numbness of the fingers and toes 7. others symptoms, mention ……	1. [ ] 4 opts or more of 1-6 2. [ ] 2 or 3 options of 1-6 3. [ ] only 1 opt. and/or opt. 7	[ ]
C-13. Can you please tell me the **effects** an individual can have when he or she does not have enough blood? 1. Impaired growth, cognitive performance and learning ability 2. Poor pregnancy outcomes such as low birth weight, abortions, and premature deliveries 3. Increased susceptibility to infections because of decreased immunity 4. Increased maternal mortality 5 Dizziness, headache, palpitations, swelling of the body 6 Death 7. Others effects, mention …..……	1. [ ] 3 or more opt. of 1-5 2. [ ] only 2 options of 1-5 3. [ ] only 1 and/or opt. 6	[ ]
C-14. In your **opinion**, what will you do to yourself or to your relative who does not have enough blood? 1. Send him or her to the health facility (hospital, health centre, dispensary, health clinic) 2. I will eat or provide him/her good food (nutritious food) 3. I will do self-medication/buy drugs and treat myself or treat him/her 4 Send him or her to the traditional healer 5 Other, please mention …….	1. [ ] option 1 and/or 2 2. [ ] option 3 3. [ ] option 4 and/or 5	[ ]

C-15. What **initial steps** will you take to prevent the occurrence of anaemia to yourself or any other member of your family? 1. Eat nutritious foods like meat, fish, liver. Sardines and eggs 2. Use of supplements 3. Prevent from getting diseases such as malaria, parasitic infections, and schistosomiasis 4. To eat fruits like oranges, papaw, baobab and *ukwaji* 5. To eat vegetables like amaranth, cassava leaves, sweat potato leaves and pumpkins leaves 6. Other measures, please mention ……	1. [ ] 3 or more opt. of 1-5 2. [ ] only 2 options of 1-5 3. [ ] only 1 option and/or 6	[ ]
C-16. According to your understanding, do you think food can help to prevent or treat anaemia (*upungufu wa damu*) If the answer is **no** in question C-16 above ask question C-18	1. [ ] Yes (go to C-17) 3. [ ] No (go to C-18)	[ ]
C-17. If the answer to question C-16 above is **yes**, ask the following question; Can you please mention types of foods which you think can prevent one from becoming anaemic, or increase the level of blood in the body 1. foods of plant origin like dark green leafy vegetables 2. Fruits like oranges, *mapera*, papaw and *ubuyu* 3. Foods of animal origin like meat, fish, liver and kidneys 4. I do not know 5. Others foods; please mention …… 6. not applicable	1. [ ] all 3 options 1-3 2. [ ] only 2 opts. of 1-3 3. [ ] only 1 opt. of 1-3 and/or 4 or 5 9. [ ] not applicable	[ ]
C-18. What would you consider as the best way of feeding your baby in order that he/she does not become anaemic? 1. Giving fruits and or vegetables 2. Exclusive breast feeding the child up to the age of 4 to 6 months 3. To continue with breast-feeding until the child is 2 years and beyond 4. Feed more frequently on foods of **animal** origin 5. Feed more frequently on foods of **plant** origin 6. Others, please mention ……..	1. [ ] 3 or more of opt. 1-4 2. [ ] only 2 opt. of 1-4 3. [ ] only 1 opt. of 1-4 and/or 5 and/or 6	[ ]
C-19. What is your **opinion** to giving your children dark green leafy vegetables? …… ……..….		[ ]
C-20. What **other measures** do you think are important to prevent diseases, which can cause anaemia? 1. Wearing of shoes 2. Use of mosquito nets and other repellents 3. Use of latrines 4. Taking drugs/going to the health facility for treatment 5. I do not know 4. Other; could you please mention ……	1. [ ] 3 or more opt. of 1-4 2. [ ] only 2 opt. of 1-4 3. [ ] only one opt. of 1-4 and/or 5 and/or 6	[ ]
C-21. Have you **ever heard** of tablets, which can increase blood in the body? If the answer is **yes**, ask question C-22	1. [ ] Yes (go to C-22) 2. [ ] No	[ ]

C-22. Do you believe that taking supplements can prevent someone from becoming anaemic?	1. [ ] Yes 2. [ ] I am not sure 3. [ ] I do not believe 9. [ ] not applicable	[ ]
C-23. Do you think eating vegetables and fruits can prevent someone from becoming anaemic?	1. [ ] Yes 2. [ ] Uncertain 3. [ ] No	[ ]
C-24. For the past six months have you **ever attended** any sensitisation meeting(s) in your area addressing the problem of anaemia? If the answer is **yes**, continue with question C-25	1. [ ] Yes (then ask C-25) 2. [ ] I do not remember 3. [ ] No	[ ]
C-25. If the answer is **yes** ask the following question; how many meeting do you remember having attended ……..…	9. [ ] Not applicable	[ ]
C-26. Who was(were) responsible for conducting the meeting? 1. [ ] Health workers 2. [ ] Village health worker 3. [ ] Agriculture extension worker 4. [ ] Community development/social worker 5. [ ] Teacher 6. [ ] Community leader 7. [ ] Traditional birth attendant 8. [ ] Other; please mention …….. 9. [ ] Not applicable		1. [ ] 2. [ ] 3. [ ] 4. [ ] 5. [ ] 6. [ ] 7. [ ] 8. [ ] 9. [ ]
Ask this question to all C-27. Do you think these meetings are helpful in trying to prevent and control the problem of anaemia in the community? If the answer is **yes**, go to question C-29	1. [ ] Yes (got to C-29 2. [ ] I do not know 3. [ ] No (go to C-28)	[ ]
C-28. If the answer is **no** in question C-27 above, ask the following question: Can you please tell me why do you think that these meetings are not helpful in trying to prevent anaemia? …… ……..	9. [ ] Not applicable	[ ]
C-29. Do you practice keeping small animals/poultry at your house? If the answer is **no**, ask question C-32	1. [ ] Yes 2. [ ] No	[ ]
C-30 If the answer is **yes**, what type of animals or birds do you keep at your house? ……..	9. [ ] Not applicable	[ ]
C-31. What is the main purpose of keeping these animals or birds? 1. [ ] As a source of meat 2. [ ] Both as a source of meat and for selling 3. [ ] For selling 4. [ ] Not applicable	1. [ ] option 1 and/or 2 3. [ ] option 3 9. [ ] not applicable	[ ]
C-32. Have you ever heard of the problem of anaemia before our conversation today? If the answer is yes, ask question C-33	1. [ ] Yes 2. [ ] No	[ ]

C-33. Finally, would you please tell me where did you hear about issues related to anaemia? Through; 1. [ ] Radio 2. [ ] Newspaper 3. [ ] Village theatre groups (local drama) 4. [ ] Agriculture extension worker 5. [ ] School teachers 6. [ ] Religious leaders 7. [ ] Community based worker 8. [ ] Health workers 9. [ ] Traditional birth attendant 10. [ ] From non governmental organizations 11. [ ] Leaflets, brochures, fliers 12. [ ] Others, please mention…… 99. [ ] Not applicable		1. [ ] 2. [ ] 3. [ ] 4. [ ] 5. [ ] 6. [ ] 7. [ ] 8. [ ] 9. [ ] 10. [ ] 11. [ ] 12. [ ] 99. [ ]

SECTION C:

C-34. Do you have (mention) ……. in your family? 1. radio 2. bicycle 3. cow-pulled plough 4. cow-pulled cart	 1. [ ] Yes; 2. [ ] No 1. [ ] Yes; 2. [ ] No 1. [ ] Yes; 2. [ ] No 1. [ ] Yes; 2. [ ] No	 [ ]
C-35. Is the house you are living in (mention) …….. 1. rented 2. belonging to you If the answer is **yes** in C-35 above, continue with question C-36	 1. [ ] Yes; 2. [ ] No 1. [ ] Yes; 2. [ ] No	 [ ]
C 36. If the house belongs to him or her, observe the following and mark √ in the appropriate space. 1. has corrugated iron sheets 2. walls are build of burnt bricks 3. walls are build of cement bricks 4. walls are build of mud 5. the floor is made of cement	 1. [ ] Yes; 2. [ ] No 1. [ ] Yes; 2. [ ] No 1. [ ] Yes; 2. [ ] No 1. [ ] Yes; 2. [ ] No 1. [ ] Yes; 2. [ ] No	 1. [ ] 2. [ ] 3. [ ] 4. [ ] 5. [ ]

SECTION D: OBSERVATIONS

Observe for the presence of the following in the household;

O-1. Presence of a latrine	1. [ ] Yes 2. [ ] No	[ ]
O-2. Presence of a home yard gardening for vegetables and/or fruits	1. [ ] Vegetables 2. [ ] Fruits 3. [ ] Fruits and vegetables	[ ]
O-3. Any family member who is not wearing shoes	1. [ ] Yes 2. [ ] No	[ ]

Annex 5: Sentinel sites for anaemia surveillance in Tanzania.

	Site	District	Region	Year			
				1997	1998	1999	2000
1.	Bagamoyo	Bagamoyo	Pwani				
2.	Handeni	Handeni	Tanga	C			
3.	Igunga	Igunga	Tabora	B			
4.	Kahama	Kahama	Shinyanga	B		B	
5.	Kasulu	Kasulu	Kigoma	B			
6.	Kibondo	Kibondo	Kigoma	B	P		
7.	Kilosa	Kilosa	Morogoro	B			
8.	Kinyonga	Kilwa	Lindi		B		
9.	Kiomboi	Iramba	Singida	B	B		
10.	Kondoa	Kondoa	Dodoma	B	B	B	B
11.	Kyela	Kyela	Mbeya	B	B	B	
12.	Liwale	Liwale	Lindi		B	B	
13.	Mafinga	Mufindi	Iringa				
14.	Magu	Magu	Mwanza	B			
15.	Makiungu	Singida-R	Singida	B	B		
16.	Masasi	Masasi	Mtwara				
17.	Mbinga	Mbinga	Ruvuma	P	B		
18.	Monduli	Monduli	Arusha		B		
19.	Mpanda	Mpanda	Rukwa				
20.	Nachingwea	Nachingwea	Lindi	B	B		
21.	Nyangao	Lindi-R	Lindi				
22.	Nzega	Nzega	Tabora	B			
23.	Rubya	Muleba	Kagera				
24.	Same	Same	Kilimanjaro	B			
25.	Tarime	Tarime	Mara	B	B		

Data reported for:

C - under five children
P - pregnant women
B - both children and pregnant women

Shaded areas: - districts trained on anaemia

FOOD FREQUENCY QUESTIONNAIRE

Interviewer: For each of the food items listed in the table below ask the following question in the order the food items are listed.

How many times in the past seven (7) days, did the family members eat (mention the food item) …….....

Name of food item	1=more than once per day	2=once in a day	3=one or two days in a week	4=three to six times per week	5=never eater
(a) Main staples					
Rice					
Maize pulp					
Millet or sorghum pulp					
Other, mention ……					
(b) Dark green leafy vegetables					
Amaranth					
Cassava leaves					
Cowpea leaves					
Pumpkins leaves					
Sweat potato leaves					
Other vegetables, mention …….					
(c) Legume and legume products					
Beans					
Small beans					
Small peas					
Pigeon peas					
Others, mention ……..					
(d) Fruits					
Oranges					
Papaw					
Baobab					
Tamarind					
Guava					
Other fruits, mention …….					
(e) Foods of animal origin					
Liver					
Kidneys					
Milk					
Chicken					
Fish/Sardines					
Meat (goats, cows, sheep)					
Others, mention ……..					

Thank you for your co-operation